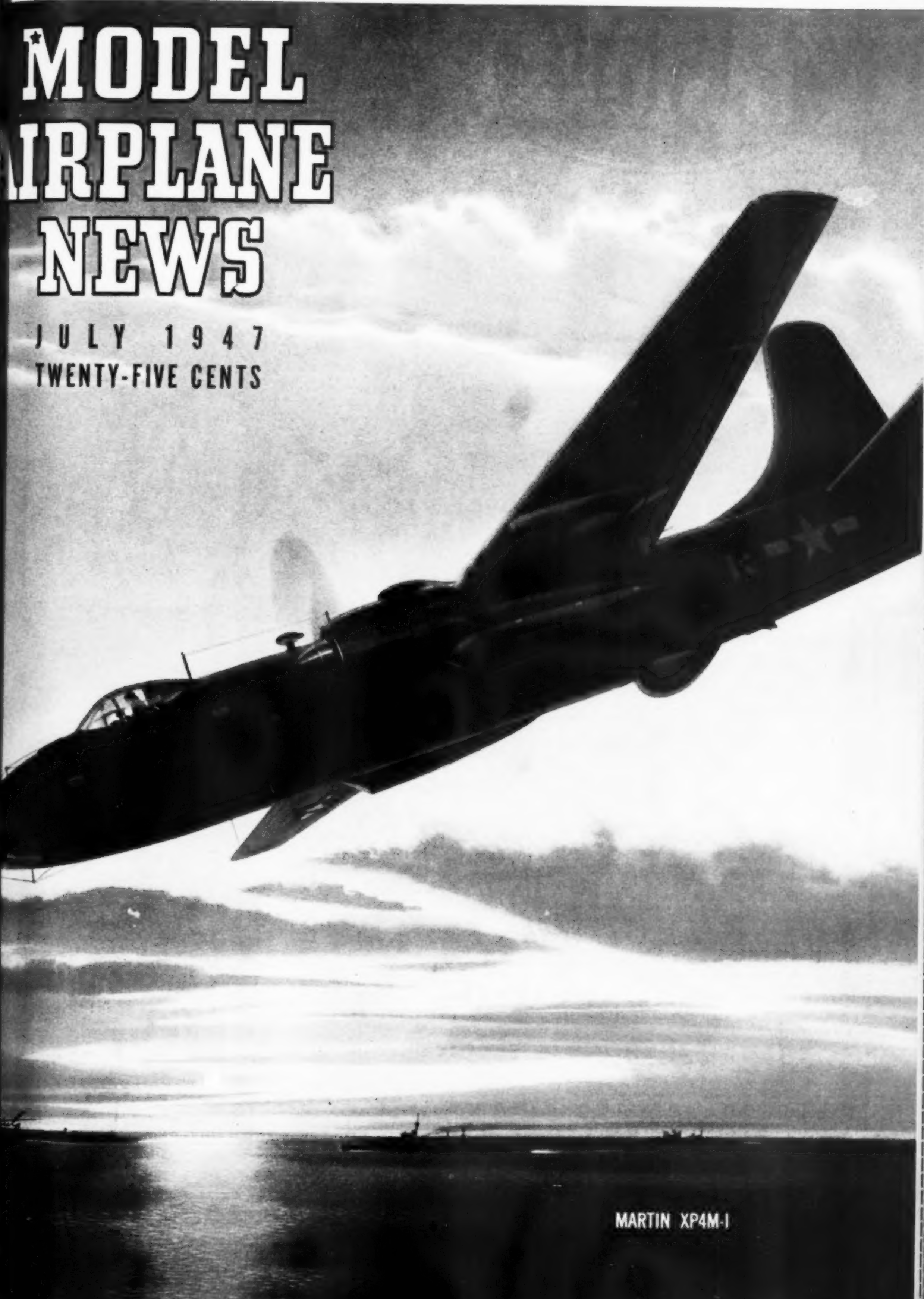
FLY BILL WINTER'S PUSHER SPORTSTER (Page 17)

MODEL AIRPLANE NEWS

JULY 1947
TWENTY-FIVE CENTS



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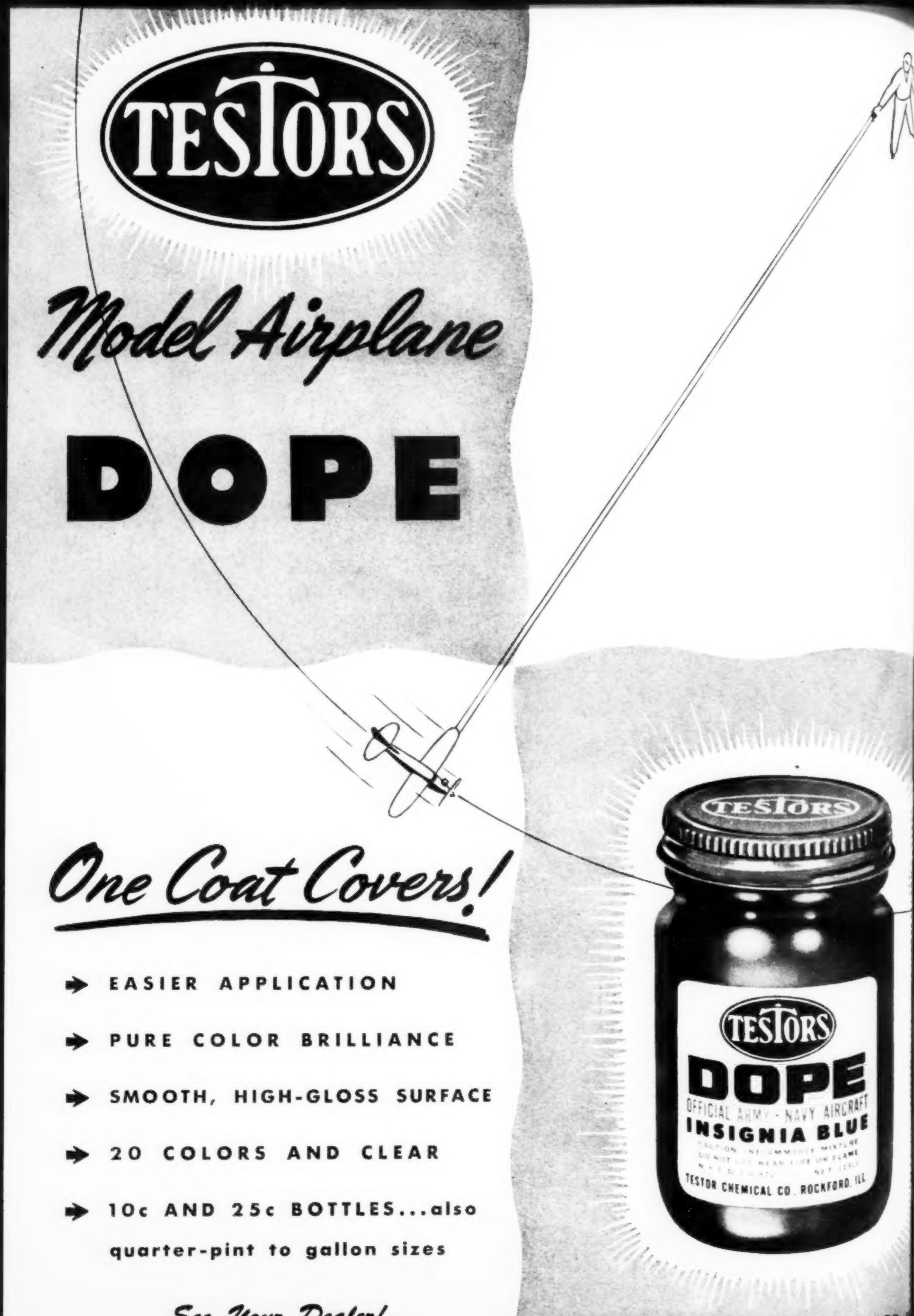
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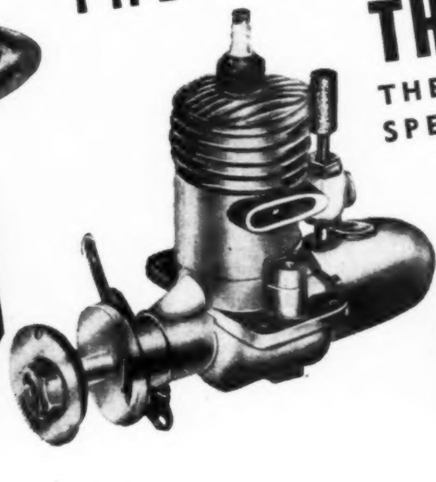

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MODEL AIRPLANE NEWS
JAY P. CLEVELAND
Publisher

Serving Aviation 19 Years

JULY 1947 VOL. XXXVII No. 1

CONTENTS

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MIDST CONSTANT reports of British superiority in jet aircraft design and construction and tacit approval of these claims on this side of the Atlantic, the U.S. aircraft industry and AAF have quietly gone about pushing America some 5 years ahead in the field of multi-jet bomber design. First to be announced was the North American XB-45 which flew successfully in March, first of its type in history. It was followed in April by the first test flight of the sleek Consolidated Vultee XB-46 4-jet bomber. Latest to join the parade is the giant Martin XB-48 powered by 6 jet engines. This huge, high-speed bomber is unique in its use of a "bicycle" landing gear in which the two main gear units are mounted tandem in the fuselage with two small outrigger wheels in the wings.

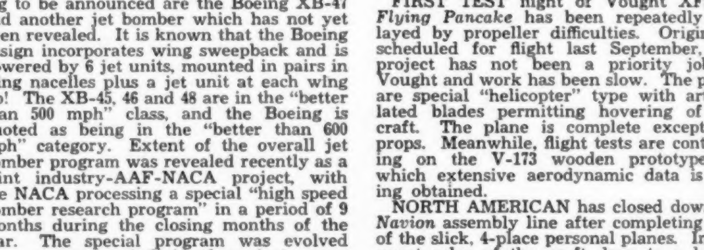
The new craft has a span of 108 ft. 4 in., is 85 ft. 9 in. long, 27 ft. 6 in. high. The jet engines are suspended 3 on each side of the fuselage below the wing and will produce an aggregate of nearly 25,000 hp, the largest power ever built into an airplane. Remaining to be announced are the Boeing XB-47 and another jet bomber which has not yet been revealed. It is known that the Boeing design incorporates wing sweepback and is powered by 6 jet units, mounted in pairs in wing nacelles plus a jet unit at each wing tip! The XB-45, 46 and 48 are in the "better than 500 mph" class, and the Boeing is quoted as being in the "better than 600 mph" category. Extent of the overall jet bomber program was revealed recently as a joint industry-AAF-NACA project, with the NACA processing a special "high speed bomber research program" in a period of 9 months during the closing months of the war. The special program was evolved after numerous individual projects were occupying vital NACA wind-tunnels, all of which were of similar design and on which similar data was being requested. NACA suggested a joint program and, with AAF approval, developed fundamental data on wings, tails, nacelles and smooth-skin construction applicable to the entire series of bombers. This program was broadened in summer of 1945 to include the Navy and the series of high-speed research airplanes now being developed.

HUGHES XF-11, last of a series of three built, was successfully test flown in March by Howard Hughes, following destruction of the first airplane in which Hughes nearly lost his life. The latest airplane has conventional single-rotation propellers replacing the counter-revolving design blamed for the crash a year ago. The XF-11 resembles an enlarged Lockheed P-38 and is a photo-reconnaissance type for high-altitude, high-speed operation. It is powered by two Pratt & Whitney R-4360 engines and carries a variety of photographic equipment. AAF has no plans for its production, having cancelled a contract for 100 on V-J Day.

FIRST TEST flight of Vought XF5U-1 *Flying Pancake* has been repeatedly delayed by propeller difficulties. Originally scheduled for flight last September, the project has not been a priority job at Vought and work has been slow. The props are special "helicopter" type with articulated blades permitting hovering of the craft. The plane is complete except for props. Meanwhile, flight tests are continuing on the V-173 wooden prototype on which extensive aerodynamic data is being obtained.

NORTH AMERICAN has closed down its *Navion* assembly line after completing 1100 of the slick, 4-place personal planes. In the event sales of the craft drop to a losing margin, NAA officials do not want to be

(*Turn to page 14*)



Carried aloft by a PB-1W (Navy B-17) a four-tenths scale model of Grumman F8F is dropped to reach speeds well over 600 mph. 500 lbs. of lead in model's nose pulls it down and it carries electric controls and radio telemetering equipment; recovery is by parachute. (Below) Sleek North American XB-45 four-jet bomber has 89 ft. span and dihedral tail

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This new 30" IT scale flying model of the Aeronca Chief personal sport-plane is a dream come true. Model has superior flying qualities, as a rubber-powered model, a model powered by the new CO-2 engine (124 sq. in. wing area), or with slightly strengthened structure a Class A or B control line model. Dry Kit IT-109........... $1.00
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WEST COAST TIPS

by JOHNNY DAVIS

NOTES on Western Open: On April 11 the Aviation Committee of Los Angeles Chamber of Commerce held its "announcement" luncheon with some of modeldom's greats in attendance: Irwin G. Ohlsson, Harry T. Rice, Bill Atwood, Dick Hulse, Pete Veir (Reginald Denny Industries), Fred Schrott, Jim Keene, Bill Clough, etc.

The program started with the showing of the films taken of the committee's recent "Palm Springs Breakfast Flight" in which over 1000 private planes took part. The meeting was then turned over to Tom Engelman—energetic Public Relations Director for Grand Central Airport, and Meet Chairman for 1947 All-Western Open—who submitted a complete outline of as beautiful a model meet as can be imagined.

He started by pointing out the purposes of the All-Western Open in promoting model aircraft development and competition in California, explaining that this year's Open has been designated the Official California State Qualifying Meet for the Nationals, and that its extent and success would have a bearing on Los Angeles' hope of bringing the Nationals to that city in 1948.

One important development which Tom touched on is the new "amateur and professional" class to be used in this year's meet. Each contestant will be asked to declare himself as either amateur or professional, in addition to his regular classification of Jr., Sr., and Open. Amateurs and professionals will compete together but will receive cash or merchandise awards—the pros getting the cash, and the amateurs receiving like value in merchandise. (Example: A man will be entered as a senior amateur or a senior professional).

A weekly newsletter on the Western Open will be circulated for two months previous to the contest (scheduled for June 27-28-29) in order to bring all contestants up to date on the status of each and every detail of the meet. An awards banquet will be scheduled on the last day of the meet. The M.I.A. will be invited to conduct a West Coast showing of products which will be open to the public. All California A.M.A. leader members will be asked to schedule a mass meeting to elect their 1948 representatives to the A.M.A. A total of 17 committees were already functioning as of the date these events were announced.

* *

Dates on the East-West Challenge Meet decided: Chairman Dr. W. C. "Buzz" Darnell announced that the local qualifying meets for the West Coast will be held April 26, the regionals on May 25, and the West Coast finals in Alameda June 15. He further stated that St. Louis has been designated as the locale for the great "Tiff," and the date set for that meeting is Sept. 13-14.

At the present time plans are under way

Ed Broughton (left), a West Coast Champ of the 30's chats with Lew Mahieu, a member of Western team at 46 Nats

to provide a distinctive uniform for the "Western Champs" to wear on their trip back East.

* *

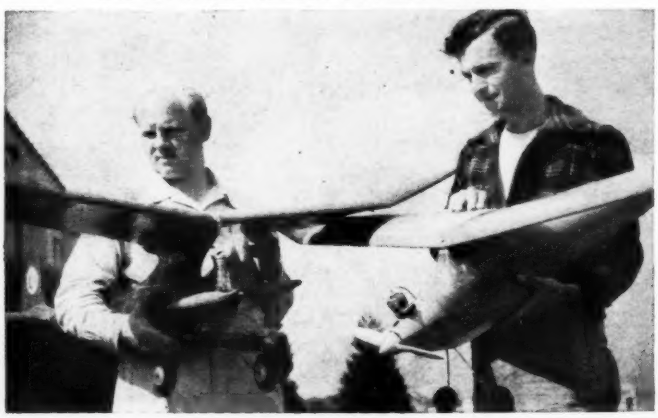
Guess who recently set a new R.O.W. Free Flight record? All set!—Don Newberger! Yep, the old speed king himself. It just goes to show that if a fellow is a champion it doesn't matter what he does, he is going to do it right. (Incidentally, here's a tip that should also stir up some of the control line boys. Don has been hitting *over* 130 mph in recent test flights with his new Class V ship, powered with a McCoy 49. That will really give the boys something to shoot at.)

All this past winter we have been hearing rumblings about this year's big contest. At last year's Western Open the Free Flight boys took most of the prizes because of the varied number of events they could enter, including rubber powered and indoor events, so that a lot of the better control line boys were splitting less and less.

This year, we are told, comes the revolution! All the control line boys are also making free flight jobs, hand-launched gliders, towline gliders, etc. so that if any prizes are given away, they will have a chance. We have heard lots of free flight boys say it doesn't require any special skill

(*Turn to page 8*)

Two free flight champs from Bakersfield who may give the L. A. boys trouble. Francis Stewart (left) and Bud Chapman



(Continued from page 6)

to fly a "brick on a string," and generally say derogatory things about fellows who were afraid to crackup their models. Well—this summer will tell the tale. It should be interesting at any rate. We personally have seen the amount of skill required to really construct and fly a good control line plane, and have found that generally the control line modeler knows quite a bit more about engines and propellers than the average free flighter, probably because the control line men get more accurate records of what an individual prop does on a given engine. Anyhow, this summer will let us know the final story.

* *

The first class racing team of Joe Kitchens, Al Allen and Babe Dunning (the Santa Ana "Hot Shots") are planning an "invasion" of the Eastern States this year. All of their ships will range between 125 and 135 mph, and the boys really make consistent flights. They are definitely going out for the big prizes offered at the "super" meets which drew such anguished groans from Westerners last year when the prizes were announced, together with the ridiculous speeds which won these prizes. The winners from last year had better jack up their speeds at least 10 mph if they want to play in the same league with the justly named "Hot Shots."

Last year the "Hot Shots" were just beginners—but if you work at something for 12 to 18 months straight you are bound to learn something, and this group has definitely found the range. Poor Easterners!

PHOTO CREDITS

Page	
2	*Upper Official U.S. Navy Photo* *Lower Acme*
22	*All Robert C. Hare*
25	*All Martin and Kelman*

THE NAVAL AIR RESERVE

THE Naval Air Reserve is set up to aid in keeping the Navy's veteran pilots in practice and to enable these veterans to pass their skill and experience on to the younger pilots. Approximately 50,000 of the 60,000 wartime Navy pilots are now back in civilian life, and the Reserve was set up to help these men keep in trim and abreast of latest developments which are coming so rapidly these days.

It is also designed to help non-flying personnel since it is recognized that it takes 10 men on the ground to keep one man in the air. The non-flying organization includes mechanics, radio maintenance personnel, instrument repairmen, armorers and many others.

The Air Reserve consists of two major parts: the *Organized Reserve*, whose members receive full pay for the scheduled time they spend at air stations or aboard Fleet carriers; and the *Volunteer Reserve*, whose members are not paid but are offered exactly the same facilities as the *Organized* group and who will gain the same valuable experience.

The Naval Air Reserve is established to protect the peace, not to wage war. It takes two years to train a competent pilot. Any nation that has a large and fully trained Air Reserve will not be considered an easy pushover by future aggressive nations, and the United States is maintaining the Naval Air Reserve as insurance for just this security.

CORRECTION

On page 57 of the June issue, the prices of the TADCO Jet Regulator appeared as $1.00, $1.25 and $2.25. The correct prices appear in the TADCO advertisement on this page.

Taylor Development Co.
N. Tonawanda, N.Y.

Model Airplane NEWSLETTER

by AL LEWIS

A BAFFLED senior adviser to a midwestern club wrote in recently asking advice on how to overcome considerable ill feeling between the free flight faction and the control line crowd. He feared the club would collapse because of the general discord and lack of cooperation between circle burners and the 20-second motor run gang.

Well, if the two groups just can't see eye to eye, and if there are not enough members who fly both types of models to effect a compromise in club activity and get everyone to cooperate for the common good—a split of the two groups sounds most logical to us.

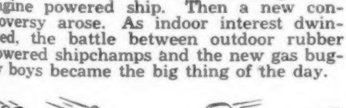
Frankly, though, doesn't it all seem like a lot of childishness? It is only natural that some enthusiasts should favor free flight over control line and vice versa. However, to gain the most all around, and to present a united front in seeking flying sites, club sponsorship, contest awards and the like, both groups should work together.

If a lot of modelers will stop quibbling over minor details and work together they will find more public acceptance of model aviation as a sport, hobby, and as a source of plenty of leisure time fun. And with such public backing, building and flying will pay off more in prizes and prestige.

Human nature being what it is, it seems only natural that some of the U-control and free flight backers should be feudin'! Mind you, we think it all very silly. But consider aeromodeling history. First there were the early model aeronauts—they built clumsy, slow flying outdoor jobs. Then refinements started coming along and the next thing was the beginning of indoor flying which resulted in a lot of super light, extremely difficult indoor endurance models.

So the indoor advocate looked down on the purely-outdoor man, while the latter scoffed at the microfilm modeler. Of course then, as now, the real experts were pretty good at both types.

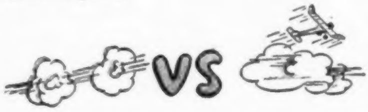
So it was indoor vs. outdoor models. And many an argument waged as to which was the more scientific type and which amounted to the most. This continued during the twin-pusher days of outdoor modeling until Maxwell Bassett set the model aero world on fire with his gasoline engine powered ship. Then a new controversy arose. As indoor interest dwindled, the battle between outdoor rubber powered shipchamps and the new gas buggy boys became the big thing of the day.



What was more efficient—a gas or a rubber powered model? Which required the most brains to build and fly? Rubber flyers wanted to throw gas bugs out of the club; exclusively gas groups came into being and scorned rubber modelers and rubber events.

And now the current controversy which we find in some sections: is it more difficult to fly free flight or control line models?

What phase of the sport produces the most promising builders? Is it better to win an event which free flighters say can be taken by a barn door providing it had enough power? Or is it smart to compete in a free flight class which almost requires you to lose your ship on an out-of-sight flight in order to place?

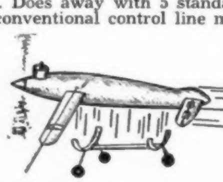


Our interest lies not in the present petty bickering, but in the debate that may lie ahead. In other words, what does the 'morrow hold? What type of modeler will be battling the control line fan? Will it be jets vs. gas and diesel in control line? Or will it be radio control vs. sonic control? Maybe turbine vs. atomic energy?

We can hardly wait!

SPEAKING OF THE model of tomorrow, you may have been seeing some of these super control line buzz jobs yourself. But in case you're surrounded by conventional designs, we report briefly the latest—and absolutely the latest—speed apparition seen on the east coast. It is merely a fuselage with droppable landing gear, a slight inboard wing to guide a single control line and an inboard stab. Motor is started by external ignition, then runs on compression-ignition.

The model has no official "hot" time. Stopwatch holders refuse as yet to believe it flies, and claim the designer does it by hypnotism. Watch next month's column and we'll unveil a new engine that is guaranteed to be the best yet for control line speed bugs. Does away with 5 standard parts of the conventional control line model.



MODEL AVIATION and related hobbies are swinging into their pre-war stride with the announcement of a series of hobby fairs and model shows scheduled this summer and fall throughout the nation. Oakland, Calif., has a big model show in the works which will be run by and for the benefit of the Boys Club. Prizes will be given for control line speed and stunt flying, also a race car track will be installed.

By the time you read this, the Chicago Youth Hobby Fair will have been held at the Museum of Science and Industry under auspices of the Rotary Club. And now comes an announcement of the Philadelphia Amateur Science, Hobby and Craft Show on October 20. Add to that the Science and Craft Show scheduled for its second year in N. Y. City this fall and you have quite an impressive array of model exhibitions.

The Philadelphia affair is conducted in cooperation with the Metropolitan Council of the AMA, the Retail Model Dealers' Assoc., and the middle eastern region of the National Model Railroad Assoc.

APPOINTMENT OF Carl Hopkins of Clarksburg, W.Va., as chairman of the Model Aviation Committee, Veterans of Foreign Wars, signals the beginning of an extensive campaign to enlist support of all VFW posts in aeromodeling. Mr. Hopkins is well known to thousands of modelers. He is State Contest Director for the AMA, has served on its contest board, and has recruited hundreds of expert builders for the laboratories of NACA. Leader Hopkins started 22 boys building model planes with headquarters in an abandoned barn, and 19 years later has more than 1,000 club

(Turn to page 12)

WHERE WILL YOU BE—

ONE YEAR FROM TODAY ?

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OR—

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(Continued from page 10)

members in his home state. Carl's clubs are actively supported and financed by civic organizations and business leaders as well as by the VFW.

YOU MAY RECALL a few columns ago we discussed briefly the subject of diesel engine fuel. Well, several folks disagreed in part and we went searching for more information for you on this comparatively new subject. A prominent designer and manufacturer of compression-ignition engines came up with the following comments. We turn the rest of the column over to him and will welcome your thoughts on his remarks:

"Because of the varied comments regarding model diesel engines, many model builders and potential engine owners are in a bewildered state. Unqualified comment regarding fuel mixtures, engine operation and starting ability have complicated the situation. Diesel engines are compression ignition engines and depend upon the compression within the cylinder to ignite the highly volatile fuel.

"Factors affecting firing are actual compression and the fuel mixture (ether, oil, and/or whatever other ingredients are used) plus the manner in which this fuel mixture combines with air. These three factors are of utmost importance. A variance of any of the three from original specified standards will affect operation. This should not be construed to mean that operation of this type engine is critical; instead it is fairly flexible.

"Ether mixed with lubricating oils has been known to fire at relative low temperatures when compressed in model engines with a ratio of 13 to 1 up to 22 to 1. Here are a few facts regarding the stability of ether. Ether is very volatile and evaporates readily when exposed to air. When combined with oil, it acts as a solvent and makes a less volatile mixture and a more stable fluid—stable in regard to evaporating qualities.

"I have exposed diesel fuel mixtures to the air for a week and afterwards ran a diesel on them without noticeable effect. Diesel fuel, when kept in a can with a screw cap, can be stored indefinitely—equally as long as regular racing or hot fuels. This point should be stressed to counteract previous comments. Ether does not affect dope or laquer finishes, nor will it dissolve dried glue.

"In regard to the starting ability, the diesel engine with the higher compression ratio is the most easily started. An engine with a longer stroke than bore is the easiest starting since it can compress the fuel in the cylinder more quickly and with less effort or fly-wheel action. This type engine should not have the rpm of the short stroke or "square type" engine. Instead, it will deliver more power per stroke when combined with a high pitch or large diameter propeller and makes an extremely efficient combination. Some builders are of the opinion that a heavy metal propeller or fly wheel is required for the operation of a miniature diesel engine. This is not correct.

"Concerning the life of a diesel engine, exhaustive tests have been made and one has more than 200 hours running time and is still in excellent condition with little sign of wear on the connecting rod bearing or crankcase bushing.

"The connecting rod on a diesel engine takes a terrific beating, particularly when the engine is running on a lean mixture (too little fuel mixed with the air). The design of the diesel engine becomes complicated when the connecting rod is considered. It must be light, strong, and resist all bending."

THE '47 NATIONALS

Read the background story of the coming Nationals, including notes on the flying sites to be used and the personalities involved. Full details in the August issue of MODEL AIRPLANE NEWS—on sale July 8th!

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CONTROL LINE SCALE MODELS

1 inch=1 ft size. Plus small 3-views, description, photos and data. Models may be planked or paper covered.

Packet #10PP - Fighters - all ABsmC: Hawker Typhoon 38½; North Amer. Mustang P-51 36½; Spitfire IX 37; Focke Wulf 190A3 34; Vought Corsair 38.

Packet #11PP - Fighters - all ABsmC: Republic Thunderbolt P47 38; Bell Aircobra P39C 33; Grumman Hellcat F6F 38; Curtiss P40F 37; Mitsubishi S-00 Zero 40.

Packet #12PP - Fighters: Bell Kingcobra P-63 37½ ABsmC; Messerschmitt 109 32 ABsmC; P38 Lightning 52 BC; Hawker Tempest 34½ ABsmC; Douglass Dauntless SBD 40 ABsmC.

Packet #13PP - World War I - allAB: Nieuport 17C.1 28½; Spad 13C.1 28; Fokker D8 261; Fokker D7 22½; Sopwith Camel 27½.

Packet #14PP - Lightplanes - all AB: Piper Skycycle 30; Johnson Rocket 31; Globe Swift 29; Ercoupe 30; Culver V 29.

Packet #15PP - National Air Racers: Gee-Bee 25AB; Howard Ike 30 lgBC; Folkerts 20 AB; Wedell Williams 26 lgBC; Pesco Spec. 25 BC.

SCALE MODELS

Quarter inch=1 ft plans. Detailed 3-views, rivet lines, photos, history of each plane, description and performance data.

Packet #1PP - Fighters: Lockheed Lightning P-38 13; Hawker Typhoon 10½; Focke-Wulf 190A3 8½; Spitfire IX 9½; Curtiss P40F 9½; Vought Corsair F4U1 10½; DeHavilland Mosquito 13½.

Packet #2PP - Fighters: Bell Airacobra P39C 8½; Republic Thunderbolt P47 10½; Stormovik IL-2C 12½; Grumman Hellcat F6F 10½; Mitsubishi S-00 10; North Amer. Mustang P51 9½; Grumman Avenger TBF1 13½.

Packet #3PP - Fighters: Northrup Black Widow P61 16½; Hawker Hurricane 10; Hawker Tempest 10; Bell Kingcobra P63 9½; Douglas Dauntless SBD5 10½; Bell Airacomet P59A 12½; Messerschmitt 109G16 8½.

Packet #4PP - World War I Fighters: Fokker D 7 7½; Sopwith Camel 7; Fokker D8 7; Nieport 17 C.1 6½; Spad 13C.1 6½; Albatross DVa 7½; SE5a 6½.

Packet #5PP - Bombers: Martin Marauder B-26 18; North Amer. Mitchell B25 17; Consolidated Liberator B-24 27½; Avro Lancaster 26; Boeing Flying Fortress B17G 26.

CONTROL LINE & FREE FLIGHT

With photos, sketches and bill of materials

Packet #1F: Knight Twister 30CL-AB; Tethered Trainer 35CL-ABC; Hep Cat 48FF-AB; Curtiss Helldiver 32CL-ABsmC; Conn. Yankee 58FF-BsmC.

Packet #2F: Hall Racer 20CL-AB; Hill Special 20CL-AB; Gee"38" 54FF-lgAB; Culver Cadet 40CL-AB; Pusher Pursuit 24½CL-AB.

Packet #3F: Could Be 48FF-B; Flying Lab 70FF-lgBC; Corsair 35CL-lgBC; Bob Cat 24CL-B; Copperhead 25CL-B.

SCALE MODELS

1/6 in.=1 ft. scale. Regular $2.00 packets. Twenty four models per packet. An exceptional offering at $1 ea.

Packet #1APS: Fairey Battle 9; Westland Whirlwind 7½; Hawker Burricane 6½; Miles Master 6; Bristol Beaufighter 9½; Bristol Blenheim IV and IVL 9½; DeHavilland Mosquito 9; G.A.Hotspur 8; Wellesley 12½; Spitfire III & V 6½; Whitley III 14; Whitley V 14; Wellington II & III 14; Blenheim I & IV 9½; Lerwick 13½; London 13½; Beaufort 9½; Whitley IV 14; Botha 9½; Hamden & Hereford 10; Lancaster 16½; Manchester 15; Halifax 16½; Stirling 16.

Packet #2APS: Curtiss Tomahawk 6½; Martlet 6½; Douglas SBD3 7; Douglas TBD1 8½; Vangard 6; Aircobra 5½; Chesapeake 7; Lightning P38 8; Mustang 6; Lancer 6; Airacuda 12; B-26 10½; B-17E 17; Douglas DB7a 10½; Douglas Havoc 10½; B-25 11; Ventura 10½; Hudson 10½; Baltimore 10; DC-2 14; Dakota 15½; Fortress I 17; Catalina 17; C-46 18.

Packet #3APS: FW 190A3 5½; Me210A1 9; Me109E 5½; Me109F 5½; Fe156 Storch 8; Ju87B 7½; Me108B Alson 5½; Ar 958EE 7; Arado 196 7½; Ju88 A6 10½; HeIII-haE 12½; Do215 9½; Do-17-p 9½; Bv 141B 11; Do217E 10½; Ju 52/3mk 16; He IIIk 12½; Ju 90A1 10; Me110 9; Do26K 16; Bv 142 16; Fw 200B Condor 18; Fw 200K Kurier 18.

AIRFOIL SECTIONS

Packet #1AF - 10 Airfoil Sections: Full size airfoils for the original designer & experimenter - each from 3 in. to 12 in. giving 37 sizes, one-quarter inch gradations. NACA 2409; EIFFEL 400; RAF 32; CLARK Y 09%; GRANT X-9; NACA 0009; CLARK YH; NACA 2412; CLARK Y; NACA 6409.

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Flash News

(*Continued from page 2*)

"caught short" with an oversupply; the market is to be watched and carefully analyzed for a 30-60 day period before a decision is made to renew production. Spare parts production has been running well ahead of schedule, and parts for 1300 more are in stock. In event production is ceased altogether, NAA assures owners that spare parts will be available for several years.

DESPITE RUMORS to contrary, Curtiss-Wright Corp. is going ahead on its CW-32 cargo plane project and the mock-up is complete. Construction of prototype is scheduled for Columbus (Ohio) plant, and first test flight is due spring of 1948. The four-engine plane is distinctive in its hinged tail, that is hoisted upward to permit access to the cargo hold, which has 4,000 cu. ft. of space.

NAVY PIASECKI XHRP-1 has been extensively redesigned since its first flights and is now back in the air. Major changes are in powerplant, which is now a Pratt & Whitney R-1340 *Wasp* of 600 hp replacing the 450 hp Wright, and the addition of two vertical tail surfaces. Provisions for 10 passengers have been removed and it is now slated for straight cargo and air-sea rescue work during tests with the Navy. A contract for nine *Rescuer* HRP-1's was signed by Navy. The Platt-Lepage XR-1, AAF's first helicopter contract model, was abandoned for development purposes and sold to Helicopter Air Transport, the fast-growing HAT group in Camden, N. J.

NEW TURBINE engine developments may now be reported—these include a turboprop unit being developed by Allison Division of General Motors producing 18,750 hp! Frederick Flader, Inc. is working on a 7500 hp model. The long-secret Menasco jet engine is to be tested initially at 5000 lb. thrust with eventual goal 8000 lbs. of thrust. The design utilizes centrifugal compressors, axial compressors, multi-stage turbine, ducted fan and tail pipe after-burning. Allison has three new turbojet units in development stage, all of considerably greater power than existing J-33 unit.

GRUMMAN IS nearing completion on three XTB3F-1 torpedo-bombers for Navy. The design includes a reciprocating engine in nose and a turbojet unit in tail, although one of the three will be delivered for flight and stability tests without the jet unit installed. The crew, originally two placed side-by-side, has now been increased to three. Navy states no production plans have been formulated for the TB3F type.

CONSOLIDATED VULTEE B-36 production models of the giant bomber, of which 100 are on order, will differ from prototype in a bubble canopy for the flight crew and replacement of the single giant wheels with four wheels on each landing gear strut. The huge craft are well under construction at C-V's Fort Worth (Texas) plant.

FIRST U.S. jet-controlled helicopter made successful test flights. It is a design of Stanley Hiller in which a compressor, operated by the engine, forces a stream of air aft through a duct to the tail, where it turns at right angles. Hiller states his design is still only in experimental stage. First such device actually to see service was by Weir in England.

THE COMPLEXITY of modern aircraft has multiplied their construction cost to the breaking point, according to Consolidated Vultee engineers. Construction of an experimental aircraft a decade ago cost $25 per pound. New prototype aircraft cost $225 per pound for conventional type, and jet types cost as much as $400 per pound for experimental models.

NAVY Air Material Center at Philadelphia completed type tests on two British Rolls-Royce *Nene* jet engines in connection with possible production contract with Taylor Turbine Corp. of N. Y. The engine successfully completed the standard 150-hour Army-Navy test at 4500 lbs. thrust, and plans are underway for the same tests at

(*Turn to page 87*)

K&B TORPEDO *Announces*

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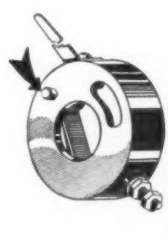
QUICK GET-AWAY

in competition is important to every contestant. That is what the exclusive K & B Torpedo less-than-3-minute, fully enclosed timer point adjustment gives you. To adjust points simply loosen nut (see illustration at right) on back of timer case, adjust points with screw driver, tighten nut to secure adjustment and you're ready to go.



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- No Engine in any class gives you more advanced features. Every
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High Compression head	$1.25
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SPECIFICATIONS

2 cycle rotary valve. .725" Bore. .724" Stroke. .299 cu. in. displacement (Conforms to A.M.A.)

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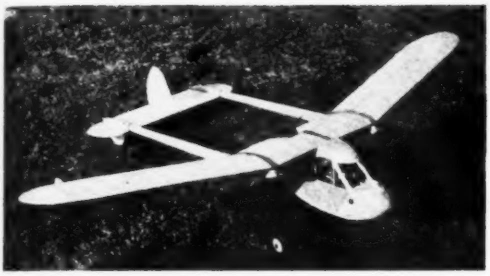
PUSHER SPORTSTER

Here is a model that was designed and built "just for fun"



THIS is not a contest model. Now, if we could have a show of hands, we bet a majority would favor the idea of building a ship for sport and nothing else. And as long as we are just fooling around with a sportster, why not try something different? If you feel the way the designer did, you too are probably tired of tractors.

There are several drawbacks to pusher designs. First, they are generally awkward machines that are difficult to trim. This is due to the weight of the engine and propeller being placed so far to the rear. If you use twin booms, there is danger of turning them into kindling in a crackup. Then the booms are apt to get in your way when you flip the propeller.

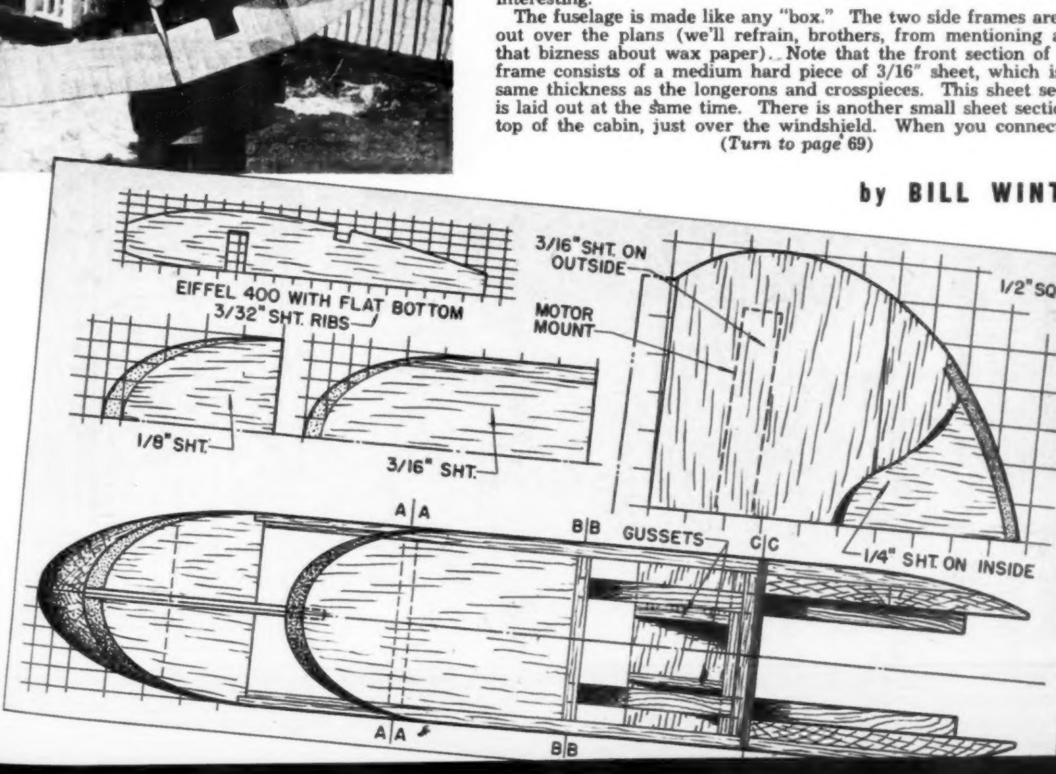
To facilitate balance we used sweepback. This enabled us to locate the engine as far forward as possible relative to the wing. Since we were not striving for high performance, the moderate loss in efficiency is nothing to be concerned about. In addition, the battery box and the coil—the heaviest available objects—are far forward in the fuselage. Not being worried about minimum wing loading for competition, we used medium sized batteries for the .199 engine. This eliminated fussing with pencells; and if you don't like the idea of long ignition wires, you've got longer lived batteries in the airplane. And of course that weight up forward helps for trimming.

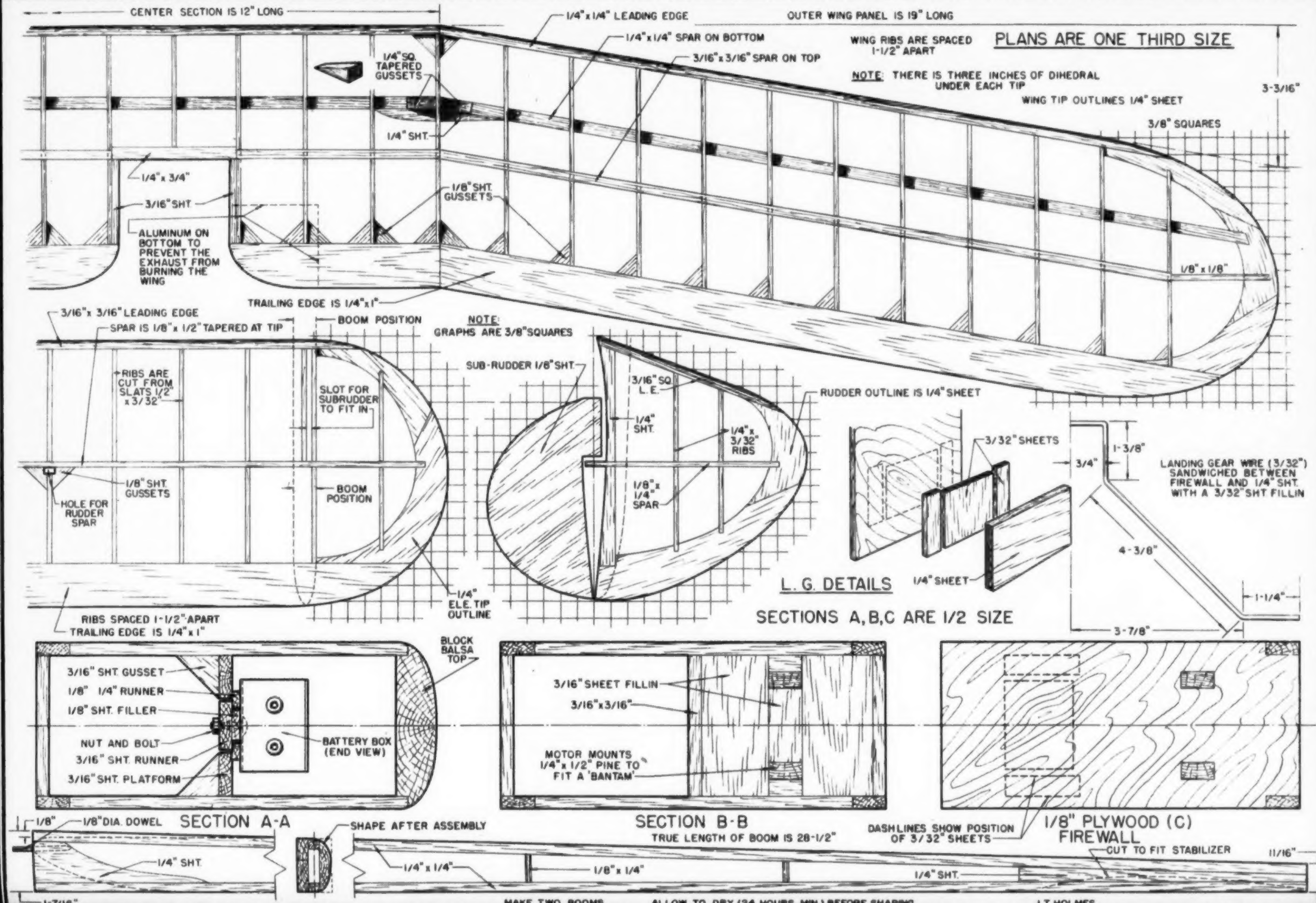
To minimize the results of possible crackups, we have attached the tail to the booms with hold-on rubbers, the booms to the wing with rubbers, and finally the wing itself is held to the fuselage by short lengths of rubber running over the centersection. The nose comprises a soft block of balsa (not hollowed) inserted between the two side frames. This will take a fair knock. And when you consider the propeller saving position of the engine, the job begins to grow interesting.

The fuselage is made like any "box." The two side frames are laid out over the plans (we'll refrain, brothers, from mentioning again that bizness about wax paper). Note that the front section of each frame consists of a medium hard piece of 3/16" sheet, which is the same thickness as the longerons and crosspieces. This sheet section is laid out at the same time. There is another small sheet section at top of the cabin, just over the windshield. When you connect the

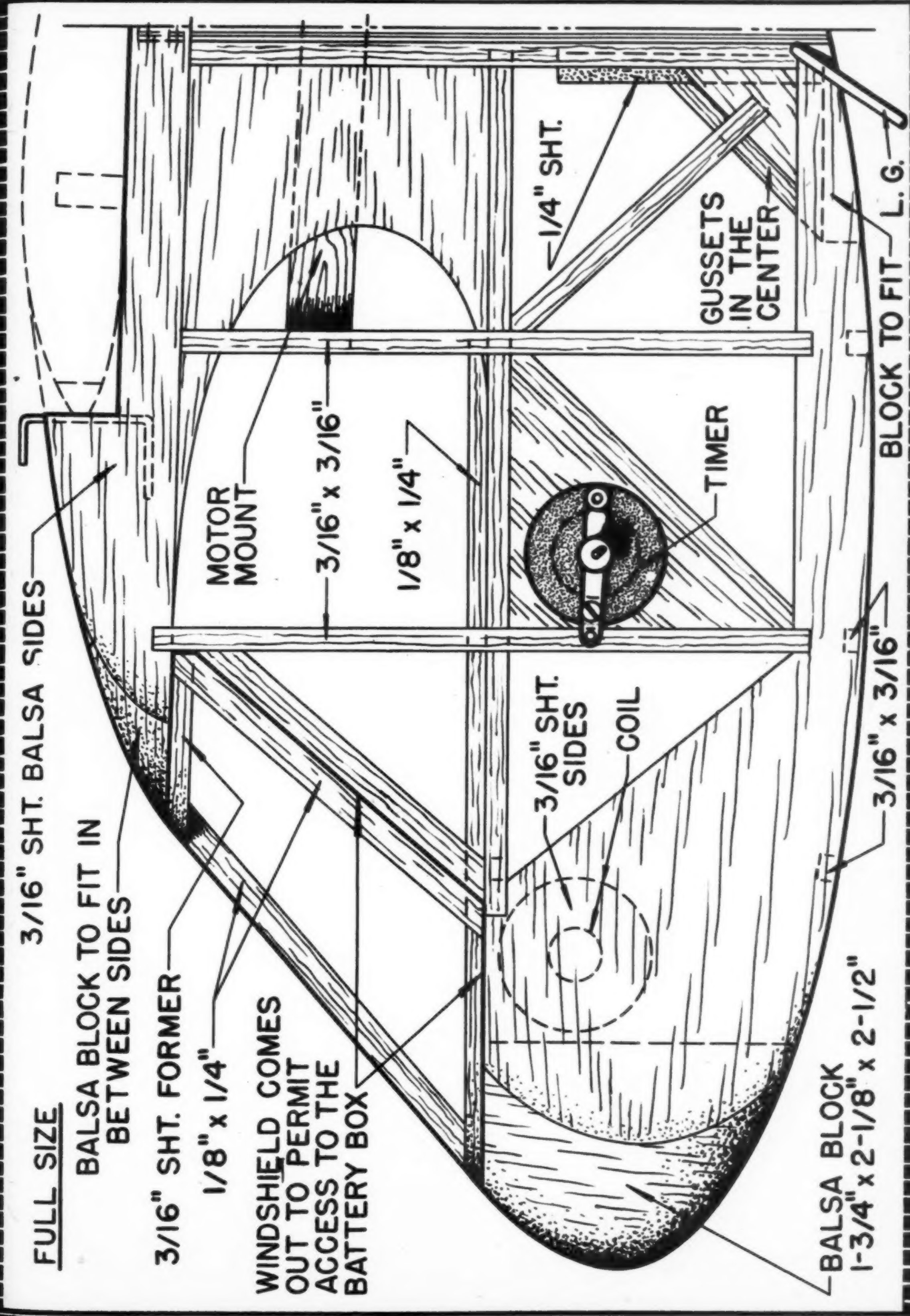
(*Turn to page 69*)

by BILL WINTER





CENTER SECTION IS 12" LONG
1/4"x1/4" LEADING EDGE
OUTER WING PANEL IS 19" LONG
1/4"x1/4" SPAR ON BOTTOM
3/16"x3/16" SPAR ON TOP
WING RIBS ARE SPACED 1-1/2" APART
PLANS ARE ONE THIRD SIZE
NOTE: THERE IS THREE INCHES OF DIHEDRAL UNDER EACH TIP
WING TIP OUTLINES 1/4" SHEET
3-3/16"
3/8" SQUARES
1/4" SQ. TAPERED GUSSETS
1/4" SHT.
1/4" x 3/4"
3/16" SHT.
ALUMINUM ON BOTTOM TO PREVENT THE EXHAUST FROM BURNING THE WING
1/8" SHT. GUSSETS
1/8" x 1/8"
TRAILING EDGE IS 1/4"x1"
3/16"x 3/16" LEADING EDGE
SPAR IS 1/8"x 1/2" TAPERED AT TIP
BOOM POSITION
NOTE: GRAPHS ARE 3/8" SQUARES
RIBS ARE CUT FROM SLATS 1/2" x 3/32"
SLOT FOR SUBRUDDER TO FIT IN
1/8" SHT. GUSSETS
HOLE FOR RUDDER SPAR
BOOM POSITION
1/4" ELE. TIP OUTLINE
RIBS SPACED 1-1/2" APART
TRAILING EDGE IS 1/4"x1"
SUB-RUDDER 1/8" SHT.
3/16" SQ. L.E.
1/4" SHT.
1/4" x 3/32" RIBS
1/8" x 1/4" SPAR
RUDDER OUTLINE IS 1/4" SHEET
3/32" SHEETS
1/4" SHEET
L. G. DETAILS
1-3/8"
3/4"
LANDING GEAR WIRE (3/32") SANDWICHED BETWEEN FIREWALL AND 1/4" SHT. WITH A 3/32" SHT FILLIN
4-3/8"
1-1/4"
3-7/8"
SECTIONS A, B, C ARE 1/2 SIZE
BLOCK BALSA TOP
3/16" SHT. GUSSET
1/8" 1/4" RUNNER
1/8" SHT. FILLER
NUT AND BOLT
3/16" SHT. RUNNER
3/16" SHT. PLATFORM
BATTERY BOX (END VIEW)
SECTION A-A
3/16" SHEET FILLIN
3/16"x3/16"
MOTOR MOUNTS 1/4"x 1/2" PINE TO FIT A 'BANTAM'
SECTION B-B
DASHLINES SHOW POSITION OF 3/32" SHEETS
1/8" PLYWOOD (C) FIREWALL
1/8"
1/8" DIA. DOWEL
SHAPE AFTER ASSEMBLY
TRUE LENGTH OF BOOM IS 28-1/2"
CUT TO FIT STABILIZER
11/16"
1/4" SHT.
1/4" x 1/4"
1/8" x 1/4"
1/4" SHT.
1-7/16"
MAKE TWO BOOMS
ALLOW TO DRY (24 HOURS MIN.) BEFORE SHAPING
J. T. HOLMES


FULL SIZE
BALSA BLOCK TO FIT IN BETWEEN SIDES
3/16" SHT. FORMER
1/8" x 1/4"
WINDSHIELD COMES OUT TO PERMIT ACCESS TO THE BATTERY BOX
3/16" SHT. BALSA SIDES
MOTOR MOUNT
3/16" x 3/16"
1/8" x 1/4"
TIMER
3/16" SHT. SIDES
COIL
1/4" SHT.
GUSSETS IN THE CENTER
L. G.
BLOCK TO FIT
3/16" x 3/16"
BALSA BLOCK 1-3/4" x 2-1/8" x 2-1/2"

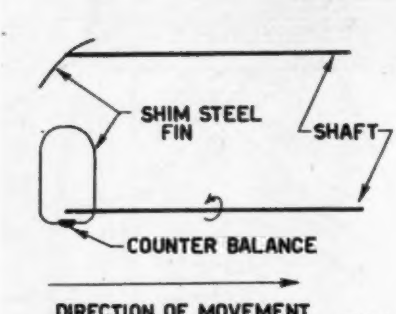


FIG. 1

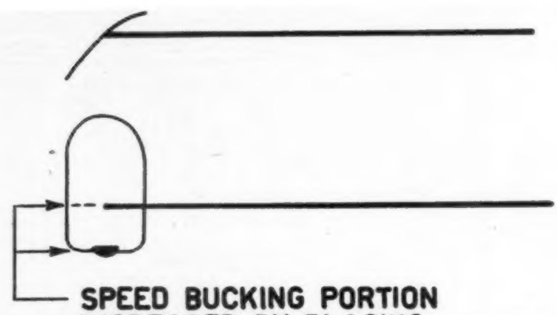


FIG. 2

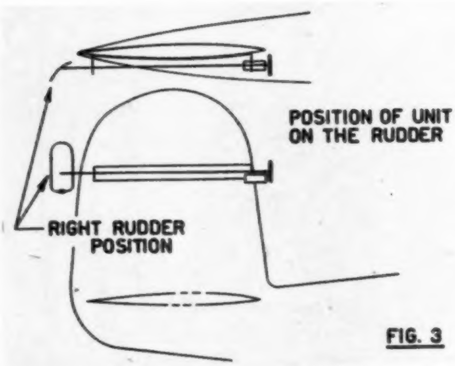


FIG. 3

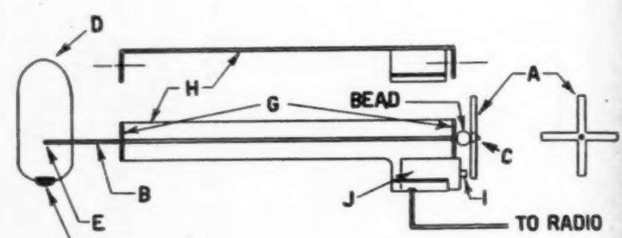


FIG. 4

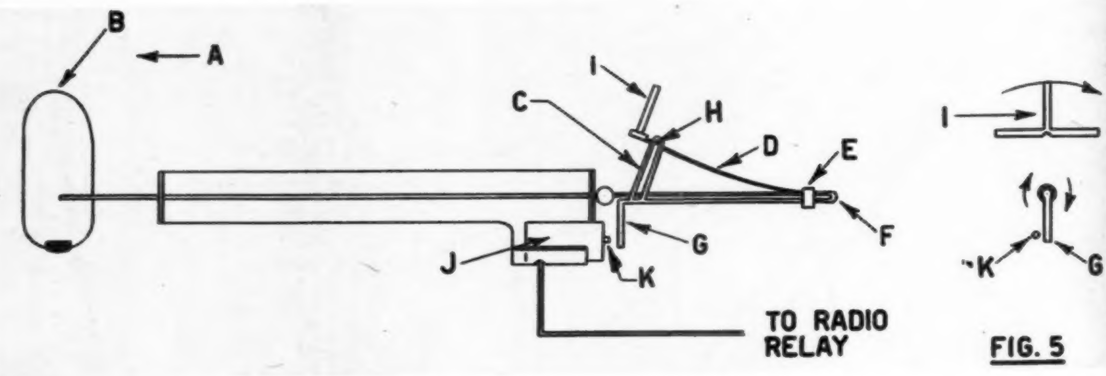


FIG. 5

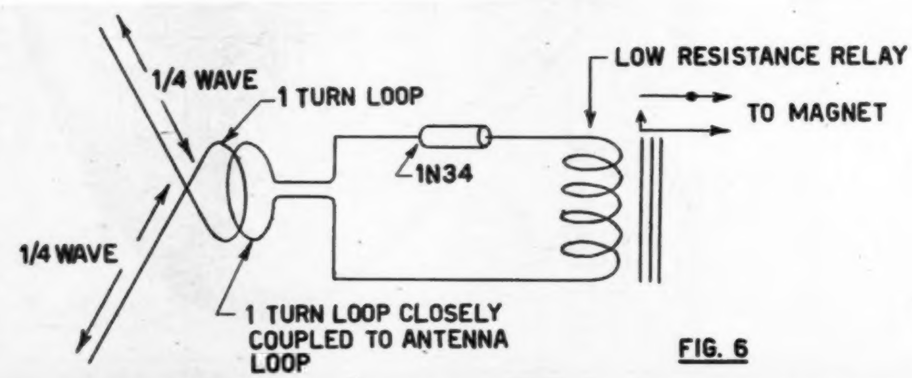


FIG. 6

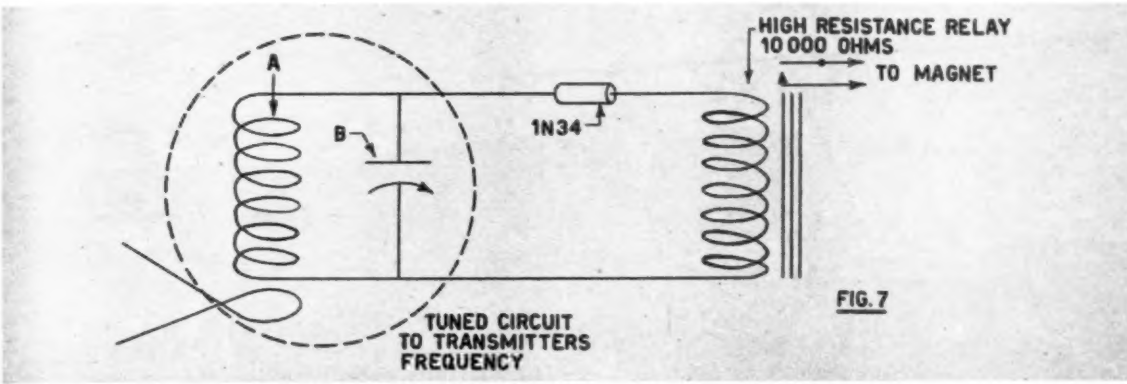


FIG. 7

SIMPLIFIED RADIO CONTROL

by WILLIAM A. RHODES

The equipment described is about as simple as it is possible to use, yet it gives altitude and directional control

IN THE fall of 1938 I was watching a small group of model enthusiasts fly their planes near Phoenix, Ariz. To see these ships wander off across the desert and lose themselves in the distance, or crash into a giant cactus just at the edge of the field when they could have been guided away from those obstructions, gave me the inspiration to construct a radio controlled craft.

Besides having the advantage of possessing an amateur radio license, I had also built quite a number of models and so had an ideal situation for constructing a radio controlled ship. As I investigated the types and methods used in radio control work, I noticed that the common trend was to manipulate the rudder and elevators and let the dihedral take care of leveling the ship when it was in neutral position. The actuation of these control surfaces is either brought about by use of a tiny electric motor with a gear train, or by using an escapement rotated by a wound rubber strand.

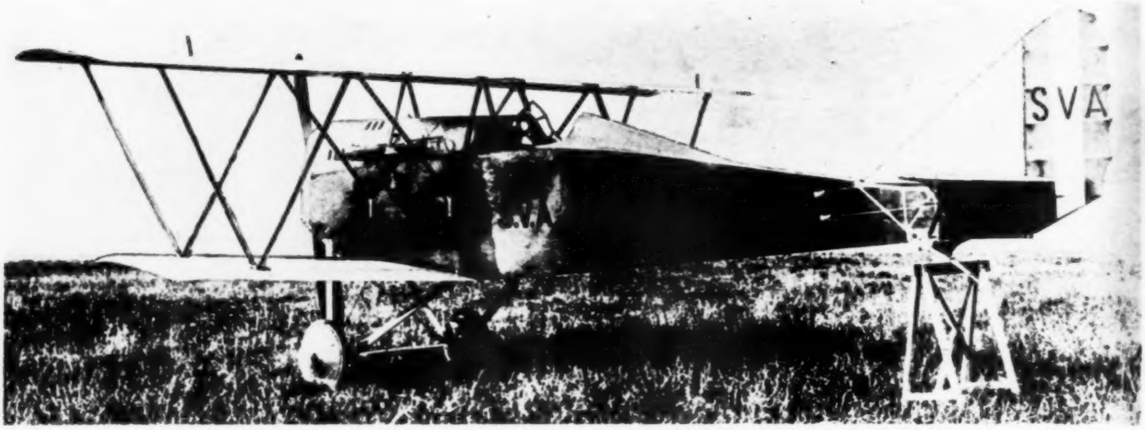
In either case, this demands using two of either of these control units plus two receivers to actuate them, not forgetting the installation of dual transmitters on the ground. If I wished I could have used half of this equipment and had control of the rudder only, but it seemed that this method was rather primitive. At the same time, those who have had experience tuning and operating just one of these units preparatory to flight know what kind of trouble one can give, let alone two.

After gathering information I finally decided to simplify the whole system. This simplification included: 1. Elimination of the electric motor and gear train and escapement. This would connect the receiver directly to the control surfaces, which necessitated redesigning the control surface actuating mechanism. 2. Using only one receiver and still being able to operate both elevator and rudder. 3. Eliminating the weight of B batteries by reorganizing the entire radio system. (A control receiver that uses no B batteries or tubes is described later in this article.)

The whole idea sounded impossible for one person to accomplish, but as time was something I had plenty of, I collected ideas which finally evolved into the present system. I do not contend that this unit is in its highest stage of development, but it has lots of possibilities and I hope that others will conduct further research to improve upon it, keeping in mind however not to let it grow into a nightmare of complication as have some units I've seen.

My first version of the revised controlling system was a device resembling a tablespoon (hence the name "spoon") made of balsa and rotated by clockwork inside the ship. This spoon was to stick out the rear of the tail assembly, and by stopping it in any one of four positions it would perform the duties of both elevator and rudder. Then, when released, it would whirl so quickly that it would not affect the ship's forward motion until stopped in one of the four control positions. Here again I was stuck with a cumbersome mechanism to drive this spoon, which just complicated matters—something I wanted to avoid. To be simple, this spoon had to drive itself. So, I thought, why not mount the spoon to one side of the shaft and counterbalance it so as to make the equivalent of a one-blade propeller (see Fig. 1). In this way it can rotate due to the passing airstream and will still act as a selective airfoil when stopped as previously described.

(*Turn to page* 71)



In this ¾ rear view of S.V.A.-5 single seat fighter, thinness of fuselage at tail is readily apparent

WORLD WAR I

by ROBERT C. HARE

ITALY'S high touted air force proved to be a washout when it was finally put to the test against the Allies in World War II. All the fanfare of a dictator's press bureau couldn't make a first-class fighting machine out of a corrupt government administration and a decadent industry. Yet in World War I, Italy's aerodynamicists were numbered among the world's finest, her factories were as efficient as could be found anywhere, and Italian designs were definitely first class.

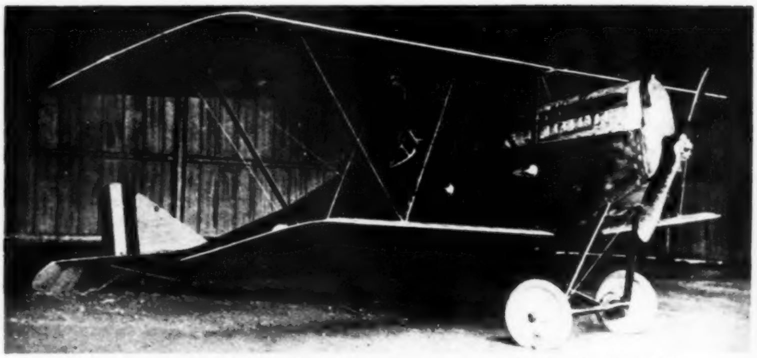
Although little has been written of Italy's contributions during the First World War, the record is an amazing one. Prior to her declaration of war against the Central Powers in May 1915, Italian inventiveness had been stifled because the government had failed to subsidize aviation. Original designs were a novelty, and manufacturers were forced to build the most successful European types under license if they expected to remain in business at all. The spur of war, however, brought forth many home designs which had existed on paper up to that time. It was made plain once government contracts were signed that companies like Caproni, Fiat, Pomilio or Ansaldo possessed staffs with inherent skill and ability, for almost overnight these and other Italian firms brought out a series of military aircraft second to none.

Probably the largest of these suppliers was a firm known as Societa Gio Ansaldo, of Genoa, an engineering and manufacturing concern comparable to Vickers of England or Krupp of Germany. At the head of this vast industrial empire, handed down from father to sons, were Pio and Mario Perrone. With unlimited funds at their disposal, the energetic Perrone brothers went into aviation in a really big way. Starting from scratch, they set up a huge factory at Borzoli near Genoa, and in just eight months they had 30,000 workmen on the payrolls. For flight testing they purchased a large tract of land six miles from the factory and constructed a first class airport. When they had difficulty in obtaining commercial steel tubing suitable for aircraft work, the Perrones built their own tube mill; and to overcome a scarcity of fabric for covering material they put up their own silk weaving plant to make a special silk and linen cloth.

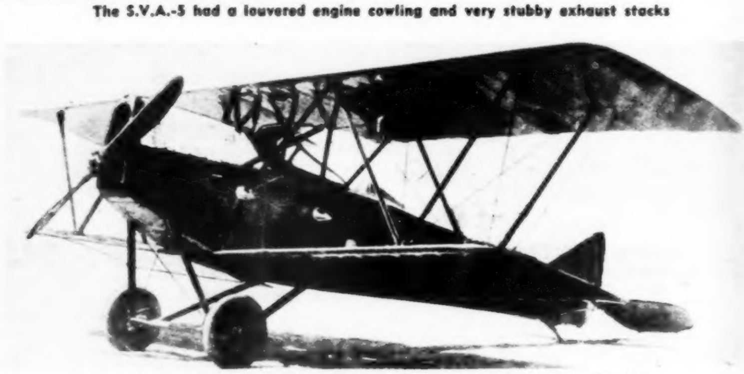
To guarantee consistent quality, the brothers established a testing laboratory for all aircraft materials and tied this in with in-plant inspections more critical than any contemporary manufacturer had even thought of. At the head of all this they placed Ing. G. Brezzi as Chief Engineer, and hired Ing. G. Verduzio, the man who did most of the deep thinking, as Chief Designer.

From these vast facilities came the famous S. V. A. series of fighter and bomber aircraft which can take their places among the most efficient and structurally unusual airplanes of their era. The initials S. V. A. were derived from the engine (S. P. A.), the plane designer (Verduzio), and the manufacturer (Ansaldo). The S. P. A. engine, with which all S. V. A. ships were fitted, was a six cylinder wa-

(Turn to page 49)



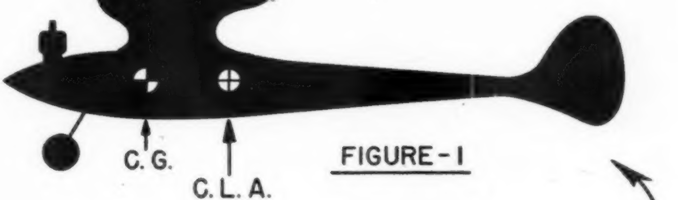
The S.V.A.-5 had a louvered engine cowling and very stubby exhaust stacks

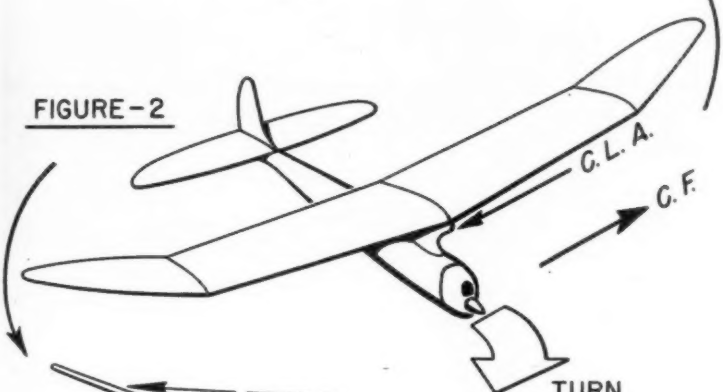


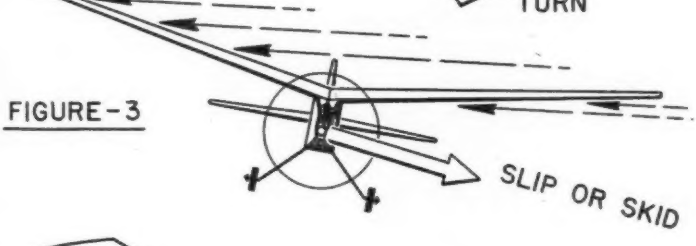
S.V.A.-4 single seat bomber had an extra strut in centersection bracing

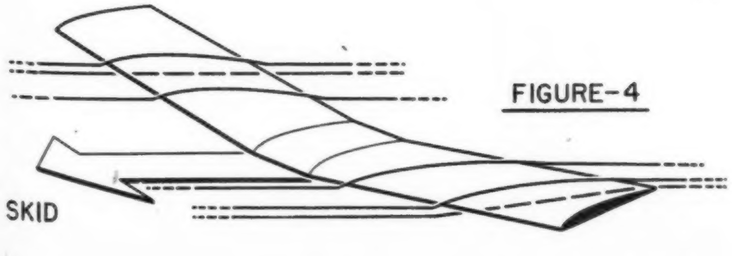
POLLY WANTS A CRACKUP

by JAMES R. CUSTIN









Polydihedral is a great thing —but only if it is used correctly

IT IS a fine summer day. The sky is blue with fluffs of cumulus, and the thermals are rising nicely. Two model airplanes are floating high in the air—one circling easily in a riser, the other sniffing for one.

And now across the field comes the buzz of a motor! A model rises in a climb above the crowd of contestants and spectators and begins to bank off to the left. The bank tightens. Down and down comes the left wing. The nose begins to drop and the buzz of the motor becomes an ominous whine. Then it hits!

The crushed wing parts company with the fuselage and bounces three feet into the air. For another second the whine of the engine can still be heard across the field—then a sudden silence. The other two models continue to circle high overhead. And the contest goes on—minus one entry. . . .

It's an old story, and an all too familiar one. Yet, as the unhappy modeler surveys the wreckage of his late pride and joy he shakes his head—he simply can't understand why it did that. For the spiral dive is at once the most baffling and costly maneuver in which a model airplane can find itself.

Occasionally the cause of spiral instability can be traced to some obvious misadjustment, such as too much wash-in or wash-out in the wing; or excessive offset of the rudder or trim tab. But most often it is hidden in the aerodynamic design of the model itself. A surprisingly large percentage of models, in fact, are spirally unstable but because of careful adjustment, low power, or just plain luck they never exhibit their inherent tendency to wind up.

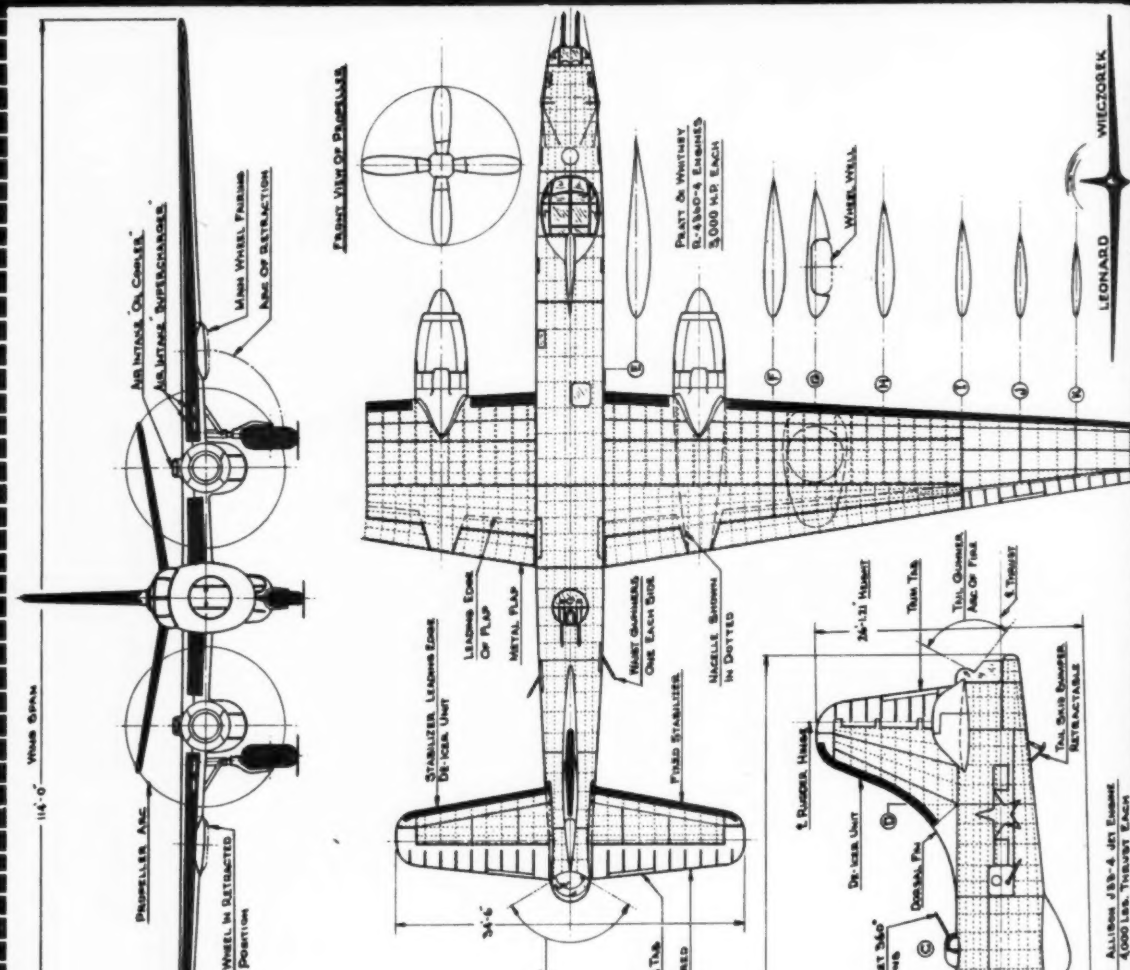
Yet the three rules for designing a model that is spirally stable are simple enough for anyone to understand and apply. The reasoning behind them is a little more difficult; but because the success or failure of a model airplane is so intimately bound up with its spiral stability, it is well worth the time and effort required to grasp this theory:

Rule 1: Keep the center of lateral area (CLA) and the center of gravity (CG) on a horizontal line with each other.

Fortunately this is not as complicated as it sounds. The center of lateral area (or center of side area) may be found in a hurry by cutting a side view silhouette of the model out of cardboard. (Scale it down if there isn't a big enough piece of cardboard around.) The point at which this silhouette balances is the CLA, and for a spirally stable model it should be some distance behind the CG and on a horizontal line with it. (See Fig. 1.)

In most cases the CLA will be found to be some distance above the CG as well as behind it. This is especially true when the wing is mounted on a high pylon. Such an arrangement results in some degree of spiral instability whenever the airplane enters a skidding turn. The sum of the relative wind forces on the side of the ship, due to the skid, may be considered as acting at the CLA (Fig. 2). This wind force forms a couple with the centrifugal force (CF) due to the turn acting on the CG and tends to twist the ship into an increasingly tighter bank. As the angle of bank increases the turn tightens, and the model spirals in.

Rule 2: Use the right combination of
(*Turn to page 62*)


XP4M-1
114'-0" Wing Span
Propeller Arc
Wheel in Retracted Position
Air Intake 'Oil Cooler'
Air Intake 'Supercharger'
Main Wheel Fairing
Arc of Retraction
Front View of Propeller
Stabilizer Leading Edge De-Icer Unit
Leading Edge of Flap
Metal Flap
Waist Gunners One Each Side
Nacelle Shown in Dotted
Fixed Stabilizer
Tail Gunner Arc of Fire
Metal Trim Tab
Fabric Covered Elevators
34'-6"
Pratt & Whitney R-4360-4 Engines 3,000 H.P. Each
Wheel Well
Leonard Wieczorek
26'-1.21" Height
Trim Tab
Tail Gunner Arc of Fire
℄ Thrust
Tail Skid Bumper Retractable
℄ Rudder Hinge
De-Icer Unit
Dorsal Fin
Remote Turret 360° 2-.50 Cal. Guns
Allison J33-4 Jet Engine 4,000 Lbs. Thrust Each
84'-8" Length
Fuselage Sections
Nacelle Profile
Nose Wheel Doors
Special Bottom View
Radar Unit
Revolving Vane
Nose Bracing and Supports
℄ Thrust

PLANE ON THE COVER

MARTIN XP4M-1

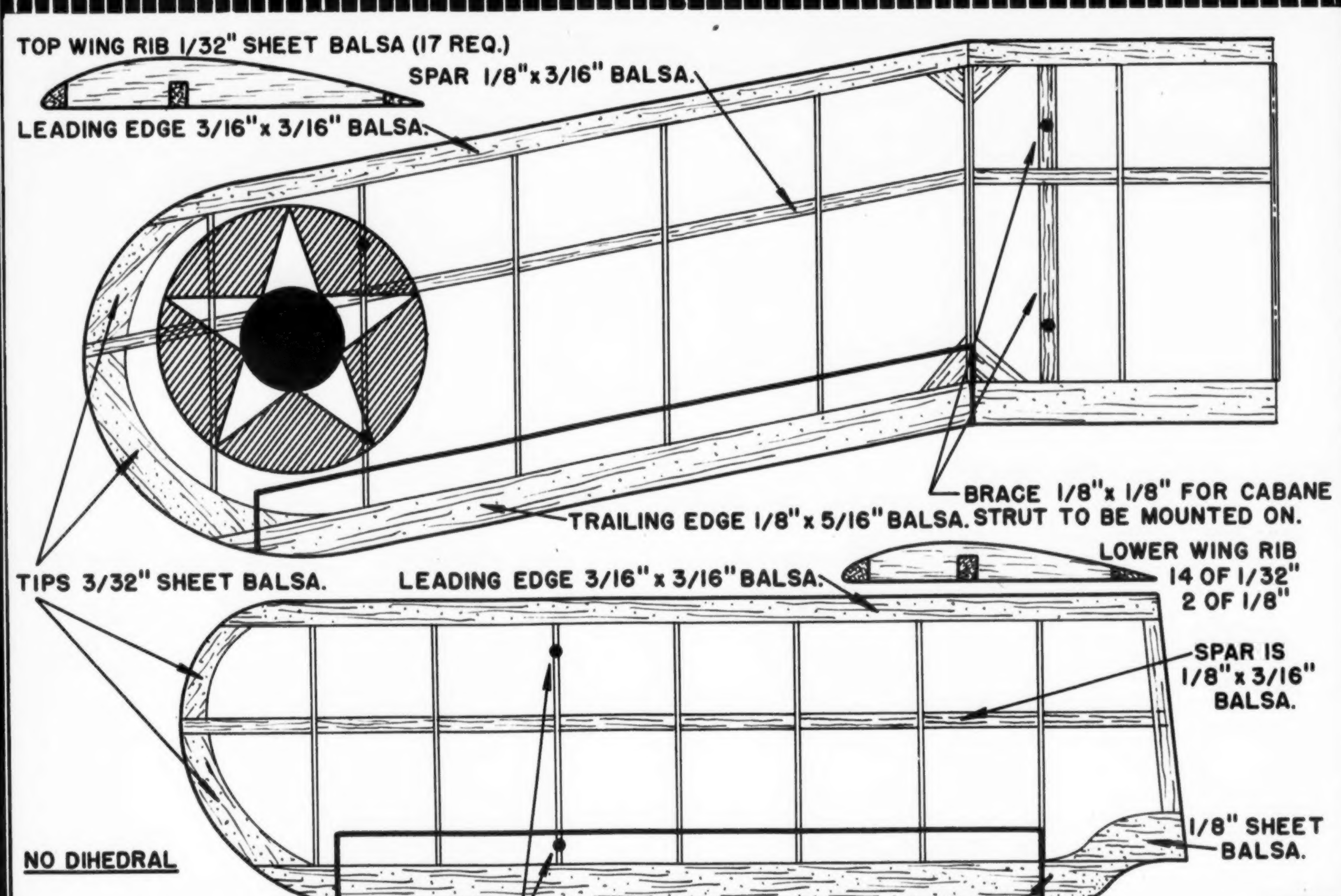
THE basis of all military tactics is a knowledge of the enemy's location, his strength, and the direction of his movements, in that order. With these factors before him, the commanding officer can intelligently make plans for action; without them he runs grave risks of disaster. And the history of warfare contains a parallel history of the development of search weapons. The Greeks used fleet-footed runners; the American Civil War saw peak development of cavalry for this purpose; World War I developed telegraphic and radio communication, observation balloons and scout airplanes in development form, and World War II brought the art to an astonishing perfection.

Long range, high-frequency radio communication coupled with the airplane nearly removed most of the possibility of secrecy of maneuver in warfare, leaving only weather as the enemy's last weapon of deception. And the miracle of radar removed that remaining cloak. Assuredly, any future war will be fought without the comfort of mystery for either contestant.

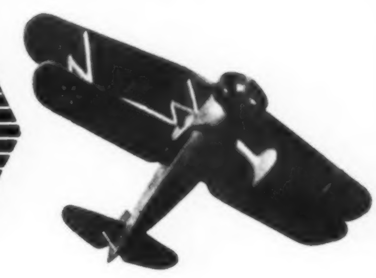
The search problem for land and sea warfare is in contrast—the land problem is one of short distances but complex terrain; the sea problem one of broad, flat surfaces but extremely long distances. Because of this latter set of conditions the naval problem has resolved itself into one of extremely long range airplanes, and the United States Navy, more than any other nation in the past quarter-century, has pioneered and excelled in this branch of warfare. Its arduous efforts in developing the patrol plane has culminated in the Martin XP4M-1, our Plane on the Cover this month.

The long range airplane is the most difficult engineering design type of any of the dozen categories now in use. It is the only type that must possess *all* the basic performance factors in a delicate balance, one against the other. It must have the fighter's speed and the bomber's load-carrying ability, and photo-reconnaissance type's high altitude and the transport's comfort and provisions for crew. Because of these facts the patrol planes of the past were big, ponderous and ugly, leading many students to dismiss them as second-best designs with undramatic utilitarian characteristics. But Consolidated Vultee, Martin, Boeing, Douglas, Lockheed and Navy Bureau of Aeronautics engineers will

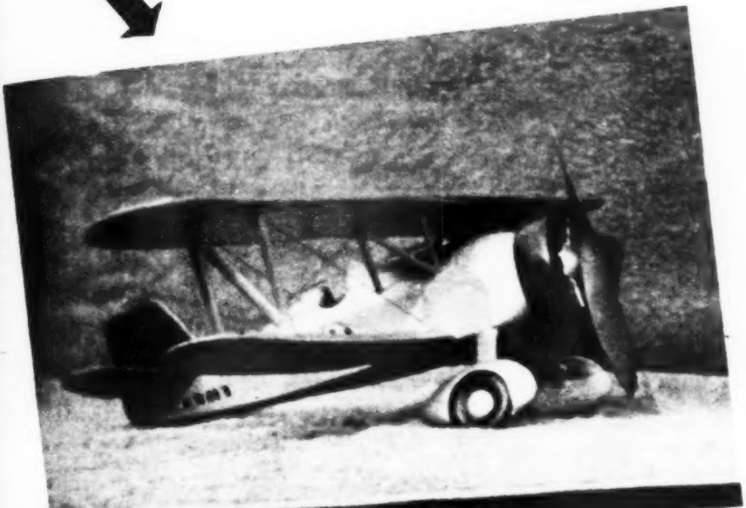
(*Turn to page 84*)

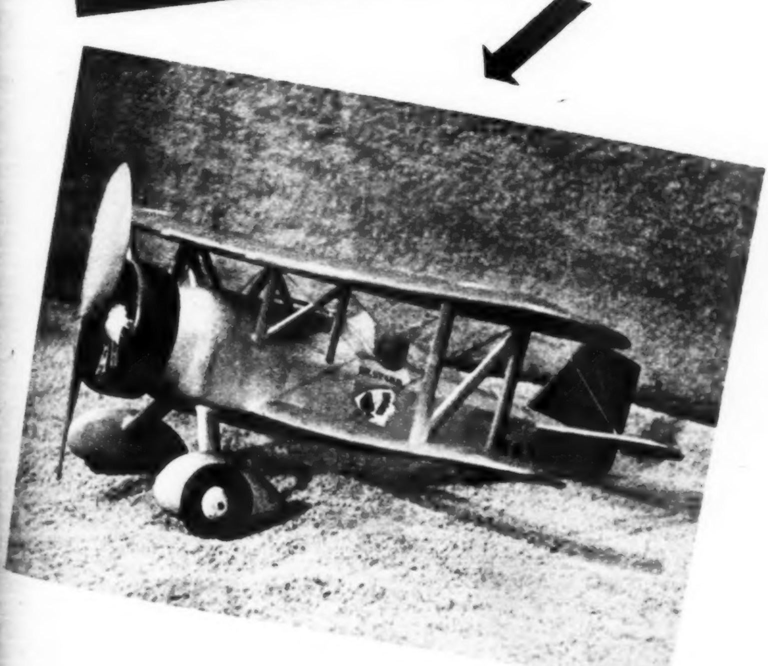

TOP WING RIB 1/32" SHEET BALSA (17 REQ.)
LEADING EDGE 3/16" x 3/16" BALSA.
SPAR 1/8" x 3/16" BALSA.
TRAILING EDGE 1/8" x 5/16" BALSA.
BRACE 1/8" x 1/8" FOR CABANE STRUT TO BE MOUNTED ON.
TIPS 3/32" SHEET BALSA.
LEADING EDGE 3/16" x 3/16" BALSA.
LOWER WING RIB 14 OF 1/32" 2 OF 1/8"
SPAR IS 1/8" x 3/16" BALSA.
1/8" SHEET BALSA.
NO DIHEDRAL
INTERPLANE STRUT LOCATIONS.
TRAILING EDGE 1/8" x 5/16" BALSA.
J.T.H.

CURTISS SEAHAWK



by PAUL MUELLER





THE Seahawk XF7C-3 was an offspring of the Curtiss Export Falcon, a two seat fighter. It was a single seat fighter to be used on carriers and was of average size with a wingspan of 32'8" and a length of 22'6". Powerful thrust was developed by its Wright Cyclone engine. The model built by the author was flown quite successfully due to the excellent proportions of the prototype.

FUSELAGE—Lay down strips of 3/32" square balsa to construct the body sides. Remove from plan and insert crossbraces. Glue the formers to the top and insert the stringers. For the nose obtain two blocks of soft balsa, glue lightly together, and carve to conform with the plan. Cut apart and hollow as shown. Fasten the blocks together again and glue to front of body frame. Cover the completed body with Jap tissue or light Silkspan. Spray the papers and allow to dry; then give it two coats of thin dope.

WINGS—Cut out the ribs as required and carve the leading and trailing edges. Pin the latter two and the spar in place, glue in ribs and allow to dry. Remove from the plan and sand smooth to remove rough spots. Cover the same as the body and be careful not to let the surfaces warp.

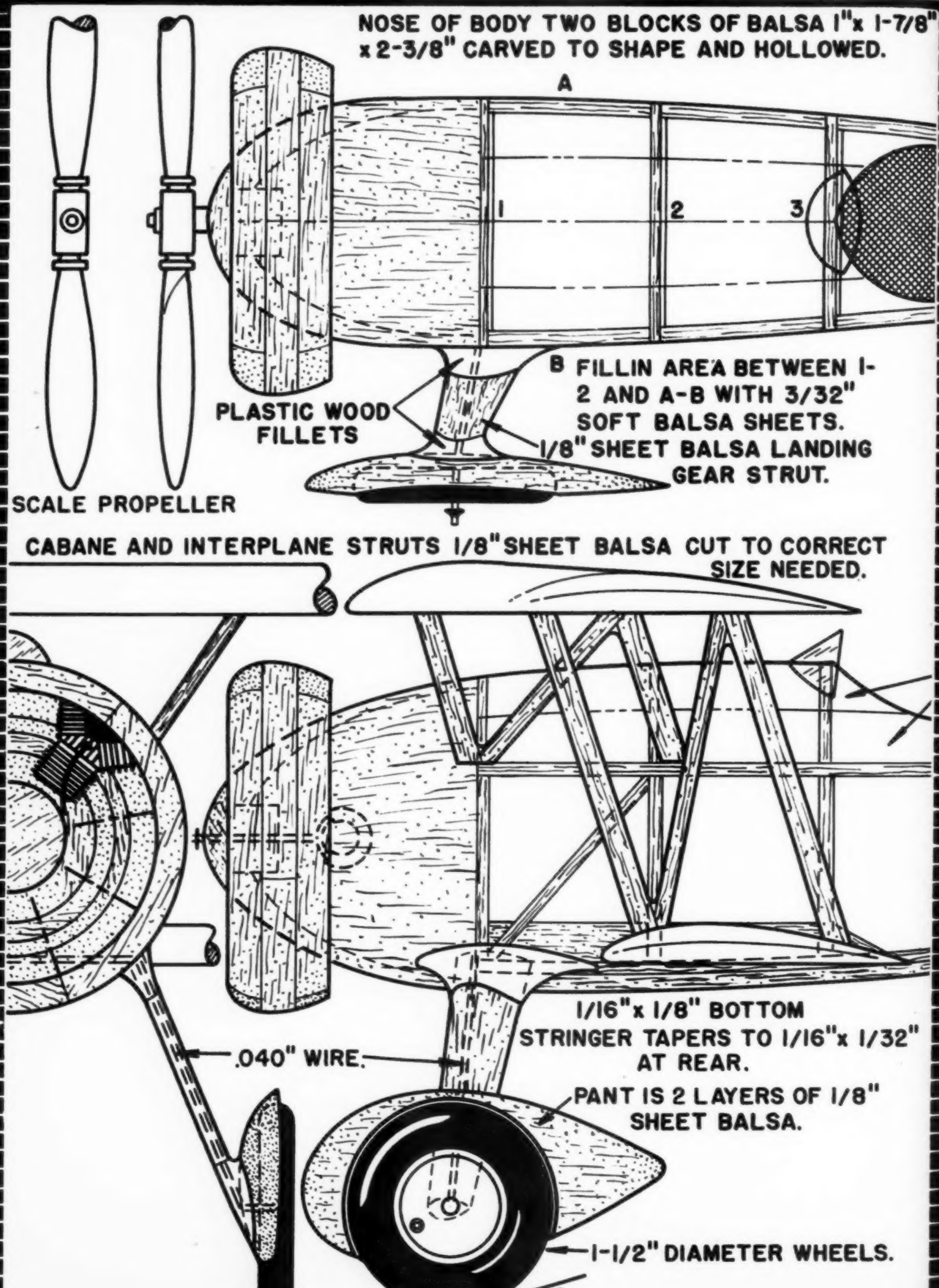
EMPENNAGE—Support the leading edge of both the elevator and the rudder off the drawing board with 1/64" sheet balsa. Lay down the 3/32" sq. spars and the 1/16" x 1/8" trailing edges and pin in place. Next glue in place the 1/32" x 1/8" ribs and allow to dry. Remove from plan and sand the 1/32" ribs to an airfoil shape. The purpose of raising the leading and trailing edge was to help place the ribs evenly. Cover the same as the wings.

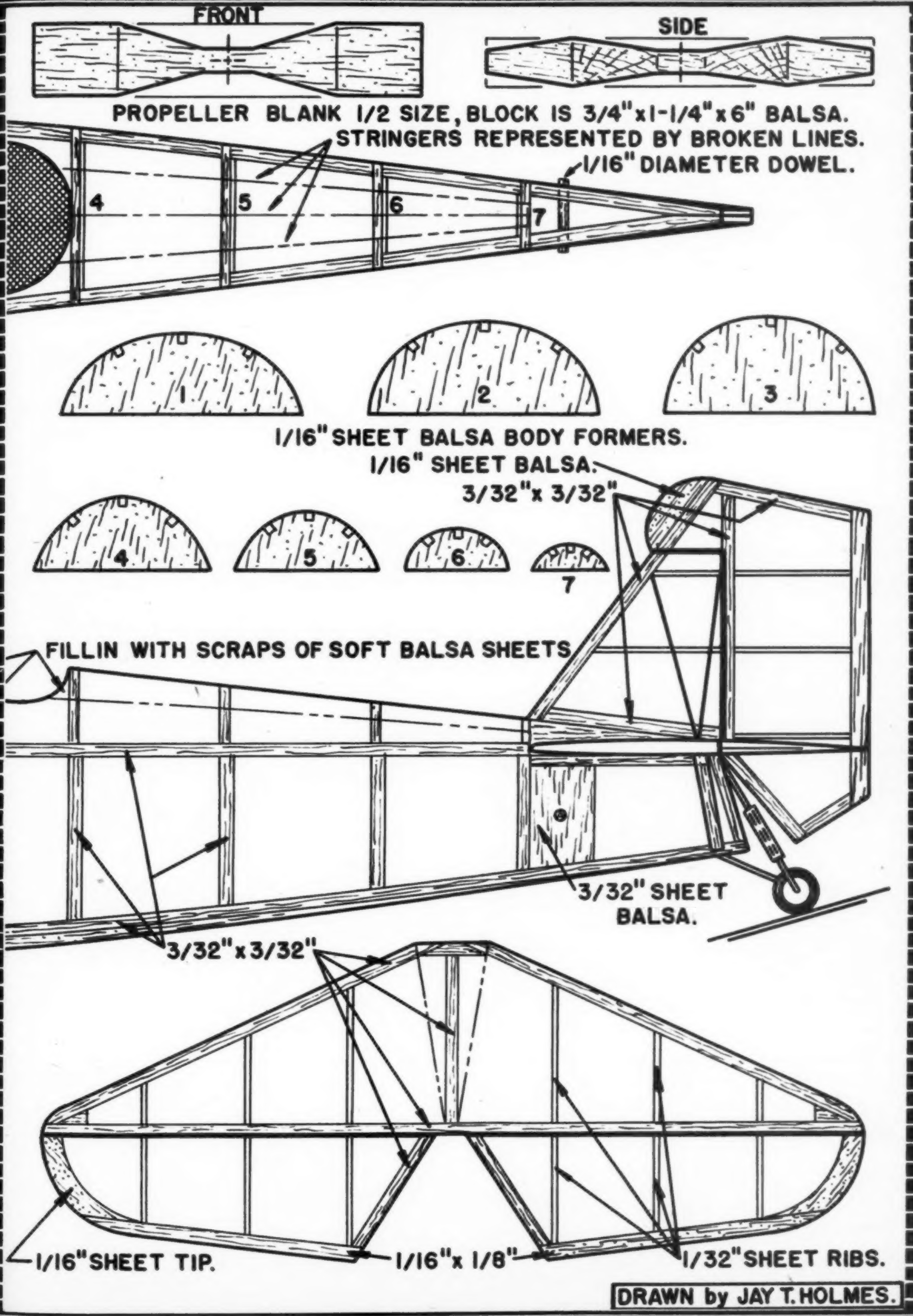
COWL AND ENGINE—The cowl is composed of three layers of 1/4" sheet balsa. These layers are made up of three segments each of which are 120° of a circle apiece, all three being glued together to form a ring. This ring in turn is shaped as shown on the plan. The cylinders are 1/8" flat pieces of balsa (9 all told). These pieces are given a half round shape and then thread is wrapped around each one to represent cooling fins. They are then glued in place around the nose of the model. Paint the cylinders and crankcase black, and add the cowl.

PROPELLER—Carve the flying prop from a medium hard block of balsa and give two or three coats of dope. Insert a wire through rear of the prop hub and bend into a loop in front, then glue in place. Add washers and a nose plug. Bend rear of wire as shown on plan and cover with rubber tubing. Use six to eight strands of 1/8" flat M.R.L. rubber, according to weight of finished model.

LANDING GEAR—Bend the wire as shown on plans and glue in place. Cut the struts from hard balsa and attach firmly to wire with glue. Carve the wheel

(*Turn to page* 48)

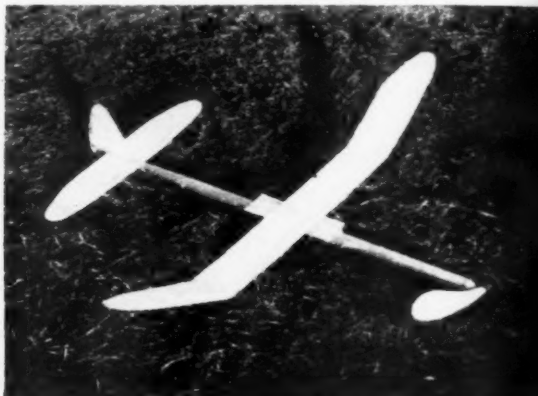

NOSE OF BODY TWO BLOCKS OF BALSA 1"x 1-7/8" x 2-3/8" CARVED TO SHAPE AND HOLLOWED.
A
1
2
3
B
FILLIN AREA BETWEEN 1-2 AND A-B WITH 3/32" SOFT BALSA SHEETS.
PLASTIC WOOD FILLETS
1/8" SHEET BALSA LANDING GEAR STRUT.
SCALE PROPELLER
CABANE AND INTERPLANE STRUTS 1/8" SHEET BALSA CUT TO CORRECT SIZE NEEDED.
1/16" x 1/8" BOTTOM STRINGER TAPERS TO 1/16" x 1/32" AT REAR.
.040" WIRE.
PANT IS 2 LAYERS OF 1/8" SHEET BALSA.
1-1/2" DIAMETER WHEELS.


FRONT
SIDE
PROPELLER BLANK 1/2 SIZE, BLOCK IS 3/4"x1-1/4"x6" BALSA.
STRINGERS REPRESENTED BY BROKEN LINES.
1/16" DIAMETER DOWEL.
4
5
6
7
1
2
3
1/16" SHEET BALSA BODY FORMERS.
1/16" SHEET BALSA.
3/32"x 3/32"
4
5
6
7
FILLIN WITH SCRAPS OF SOFT BALSA SHEETS
3/32" SHEET BALSA.
3/32"x3/32"
1/16" SHEET TIP.
1/16"x 1/8"
1/32" SHEET RIBS.
DRAWN by JAY T. HOLMES.

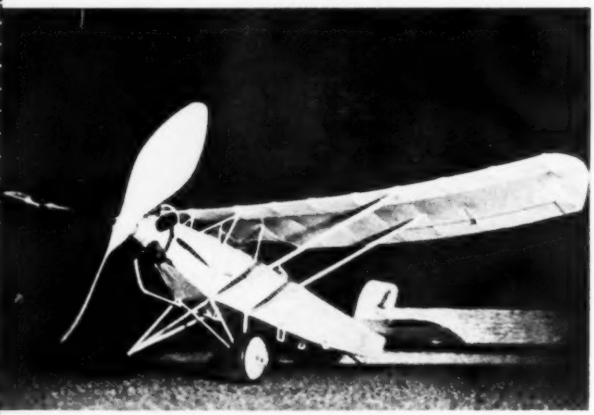
No. 1 C. Jacoby Jr. and beautiful control line DC3

No. 2 Quarter inch scale B29 by Neil Palmer, who processed photo, has many operatina details

No. 3 Swedish glider built by Oskar Eklöw has span of 150 cm



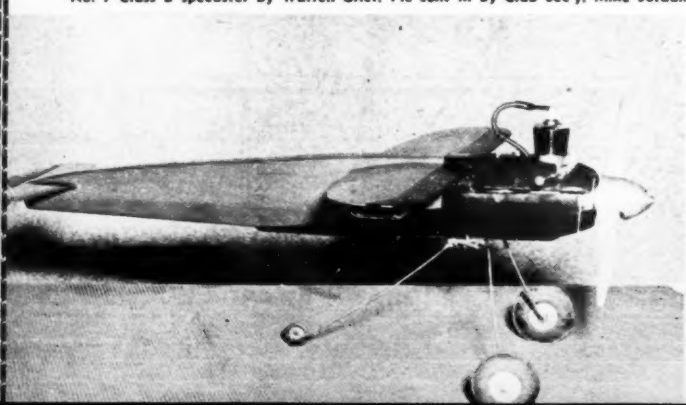
No. 4 *Duplex* from M.A.N. plans by Gerald Kluge is a reliable flier



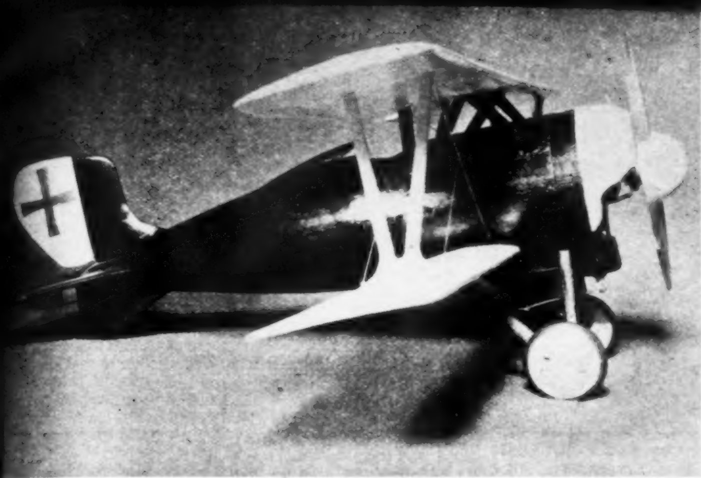
No. 5 Championship flying scale model, *Golden Eagle* by Cpl. J. Martin

No. 6 Free flight gassie scale model of Driggs *Dart* by Leland Lord

No. 7 Class B speedster by Warren Grier. Pic sent in by Club Sec'y. Mike Jordan



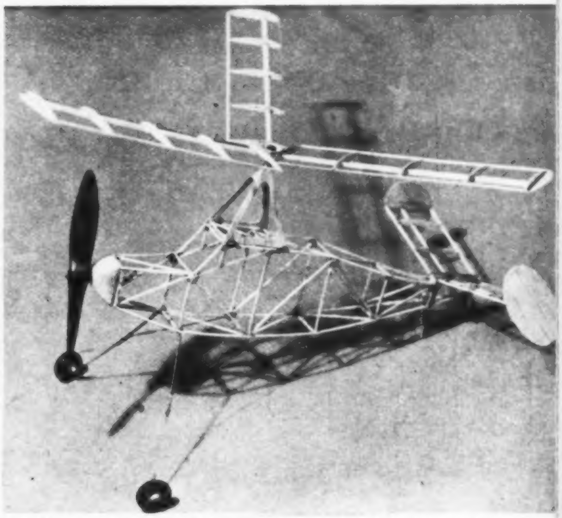
No. 8 Grumman J4F-2 amphibian by Coast Guardsman H. C. Parker



No. 9 World War I control liner, Siemens-Schuckert D-4 by C. Monson has 32" span

No. 10 Duane Wilson's free flight original has 45" span

No. 11 Sleek seaplane Swoose which John Lux is readying for summer flying



No. 12 Belgian autogiro before covering, by Guy Ramaekers of Brussels

AIR · WAYS

News of model airplane experimenters from all over the world

THE Nationals Will Be Open. In the event that any of our readers have not heard of it by this time, the 1947 Nationals will be held as an open event, same as in the past. Originally, an elaborate schedule of elimination meets was set up, but as time ran out this schedule had to be simplified until now the AMA Executive Council and Contest Board decided on the above action.

In some states the plans for elimination meets are quite far advanced and sponsors have been lined up who agreed to send the high point winners to the Nationals. It is urged that these meets be run off as scheduled, and we feel it very fitting that the winners be awarded a free trip to the big meet.

The Minnesota Committee handling details of preparation for the Nats has given assurance that their facilities will be ample to handle the extra contestants expected now that the event is open. Frank Nekimkem, a model builder of long experience who has run successful Nationals meets in Chicago in pre-war days, will be associated with the American Legion in directing the contest, and his presence assures that the model builders' slant will be paramount.

Although the meet will now be entirely open, the time and place are unchanged. See you in Minneapolis, August 18-22!

THE EAST-WEST MEET. Date and place of this classic has been set for Sept. 6 and 7 at St. Louis, Mo. The local authorities have assured Tom Herbert, contest originator, that they have available a large stadium seating 30,000 and floodlighted. Since it has been decided to hold the contest in the evening, these lights may come in handy.

Mr. Herbert mentioned in a recent letter that, while the contest is primarily between groups from the East and West *Coasts*, anyone who resides east of the Mississippi is welcome to attend the elimination and qualifying meets for the Eastern team. Further news on this contest will be found in *West Coast Tips*, page 6.

IT SEEMS THAT most of the news this month is about model meets. We have just received notification of a new invitation contest to be held for the first time this year. It is called the 1st International Model Plane Contest, sponsored by Plymouth Motor Corp., and will take place Aug. 13, 14, 15 and 16 in Detroit, Mich., home city of Plymouth. This contest will be held in conjunction with the Aero Club of Michigan and has been sanctioned by AMA; it will of course be conducted under AMA rules.

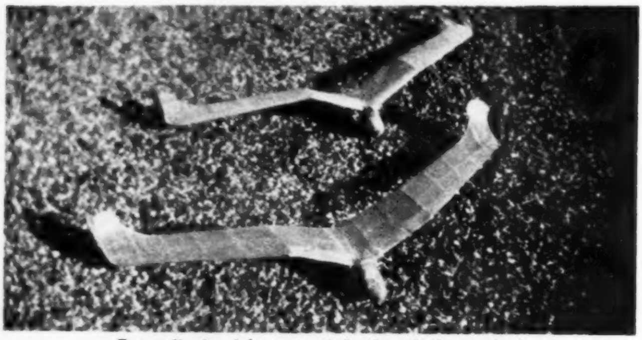
The contestants will be chosen from

(*Turn to page 77*)

TAILLESS DESIGN

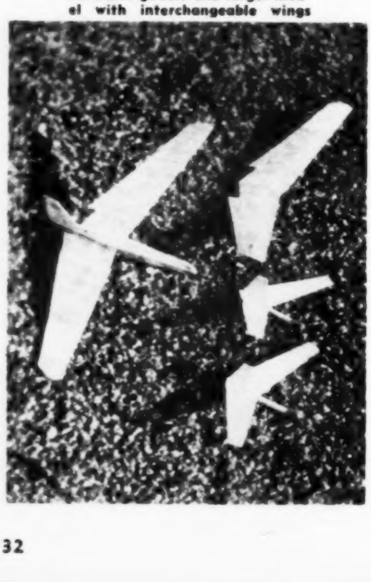
by BRUCE K. WENNERSTROM

Note the very high vertical fin used on this model

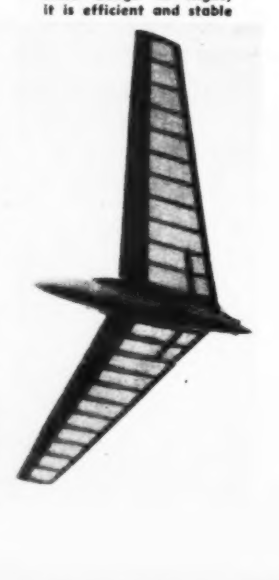


Two gull wing jobs were tried—these had sweepback

All balsa gliders and larger model with interchangeable wings



Final design in flight; it is efficient and stable



WE first became interested in flying wing designs back in '38 when we built a model of Henry Struck's tailless towline glider. The thing that amazed us most was that a "wing" would fly at all. Since then we've built quite a few of the standard sweptback type jobs in both glider and powered designs.

We eventually came to the conclusion that the conventional tractor type of model was superior to this type flying wing for contest work because: first, the rules allowed a large stab which actually made it possible to fly at a considerably lower wing loading than specified by using a lifting section. Second, wingtip stall was a big bugaboo of the all-wing model resulting in the use of tips with exaggerated washout, the drag of which was considerable and nullified somewhat the main advantage of the type, low drag. Lastly, adjustments were extremely delicate and the slightest mistake usually resulted in a spar-shattering crackup.

It was in the March '45 issue of *Air Force* that some of the advantages of the swept forward type wing were pointed out in an article entitled "Design." At the same time photos and 3 views of the XFG-1 glider were released by the Army. Our old enthusiasm for "wings" aroused, we decided to do some experimenting with the type.

We found information on aerodynamics of the craft unobtainable however. We couldn't locate any texts covering the type, and the A.A.F. released absolutely nothing of any help. Result: we had to determine everything by experiment and what we knew about conventional craft.

The swept forward type wing has three big advantages over swept-back "wings":

1. Problem of tip stall common to sweptback wing is virtually eliminated.

2. Control surfaces are located farther behind the CG than are those of a sweptback design with an equal angle of sweepback, which besides increasing controllability (controlliners please note!) permits . .

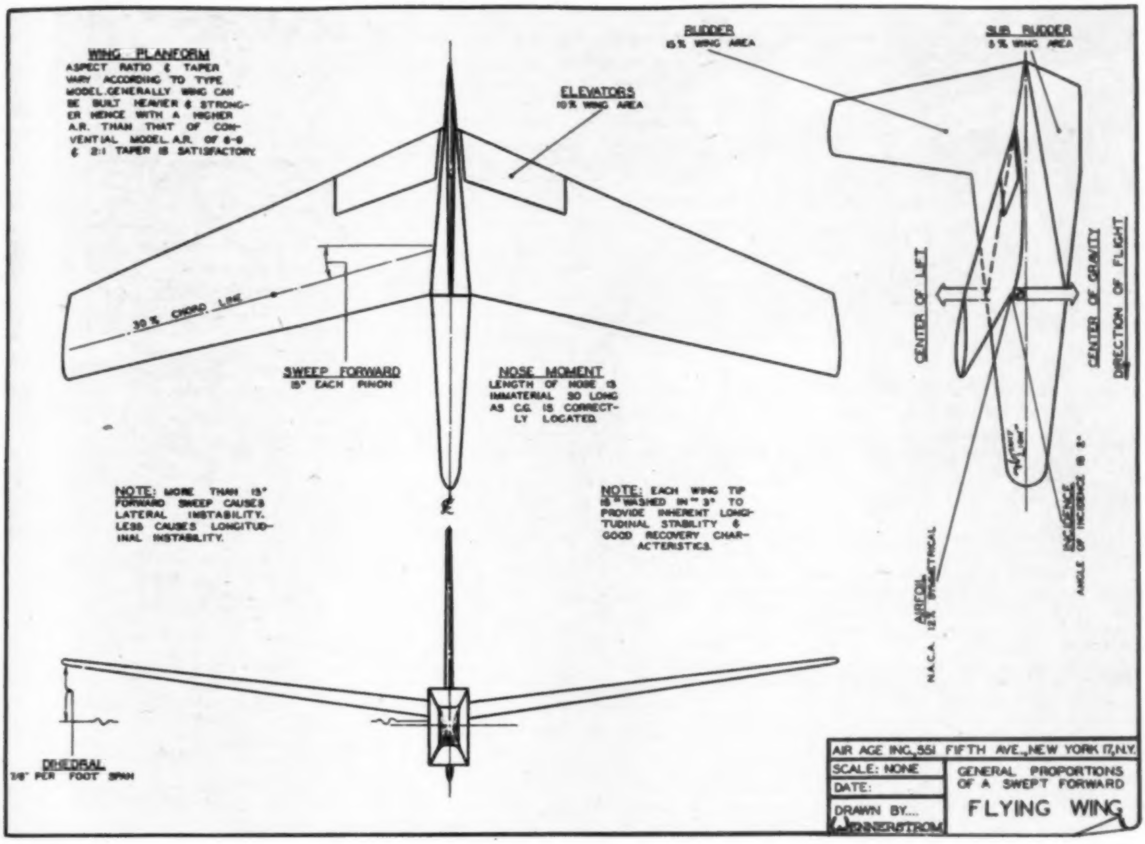
3. An increase in the CG range, or, as it affects modelers, adjustments consequently are not so touchy.

The big disadvantage of the type—so far as real planes go—is that a partial fuselage is required in order to locate the CG ahead of the wing center-section. And this in turn necessitates a vertical fin.

However, this disadvantage does not present so great a problem in model work since every model flying wing we've ever seen always had some sort of a pod to contain the engine and accessories, or if a rubber job a motor tube usually protruded from the front of the wing anyhow. Therefore between the two types it can be seen that, so far as modelwork goes, the swept forward wing has most of the advantages and few of the disadvantages of the sweptback type.

The first models we built were handlaunched gliders with flat plate airfoil wings (and hence no CP movement) in which we tried out varying amounts of forward sweep. No wash-in was incorporated; we merely hinged the elevators with scotch tape and turned them up until the ship was trimmed for a good glide. As expected, we found that considerably less forward sweep was needed than would have been necessary had the wings been swept backwards instead.

This much known, we then decided on a forward sweep of 15° in each pinion measured at the 30% wing chord line. Contrast this with the amount recently recommended by Charles Grant for a sweptback wing; at least 30° which he states may, by careful design, be cut down to 20°



each. By careful design the amount of forward sweep in our last model was only 12½°, a considerable difference. More could have been used, one of the test gliders having had 45° in each panel, but this caused lateral instability and necessitated increased dihedral. Less of an angle caused longitudinal instability and made adjustments too critical. We then made a series of built up wings for a simple box fuselage job, each wing identical in planform and dihedral but each using a different airfoil section. Four wings were built. The airfoils tested were the Clark Y, N.A.C.A. 12% symmetrical, N.A.C.A. 6409, and a reflex trailing edge section, the U.S.A. 27.

The Clark Y proved unstable. The model would go into an ever-steepening dive from which it would not pull out. No amount of negative control of the elevators would correct this condition. The N.A.C.A. 6409 gave similar results except that it could be made to stall and sawtooth down. Trimming for steady level flight could not be accomplished though. The U.S.A. 27 with its much smaller CP movement due to its reflex trailing edge gave better results, but the symmetrical section proved to be the final answer.

The dives caused by the Clark Y section during test flights in which we tried to trim the section finally wrecked the fuselage beyond repair. The second one was considerably stronger, in addition we "screwed" a coil spring part way into the wooden nose block so that afterwards the model merely bounced when it dove in.

All these tests were conducted indoors. We were stationed on Attu at the time and used the 35' x 60' maintenance room of the teletype station for the tests. These results were true and the usual variations due to winds, etc., which would otherwise have prevented accurate comparison, were absent.

Having decided on a suitable airfoil and amount of forward sweep, we set to work building a larger towline glider so that we could experiment with force arrangements. Not wanting to get too far afield, we used conventional design procedure as much as possible. Angular difference between wing and stab—in this case tip and root—we made the same as we normally used; 3°. Elevator area was 10% which ultimately proved satisfactory. 7/8" dihedral per foot of span with straight dihedral was used, and 2° incidence at the root was finally decided on.

Fin design proved to be a big problem. The most desirable location was at the extreme rear of the fuselage so that the moment arm would be maximum. However, we had learned from previous experience with models with similar setups (mostly canards) that the wing blanketed out much of the rudder at high angles of attack, especially in the near stall position which then usually resulted in the model falling off to one side. To escape this condition the rudders should be mounted on the underside of the wing—away from the fuselage—for maximum effectiveness. But with a swept forward wing this would cut the moment arm to practically nothing.

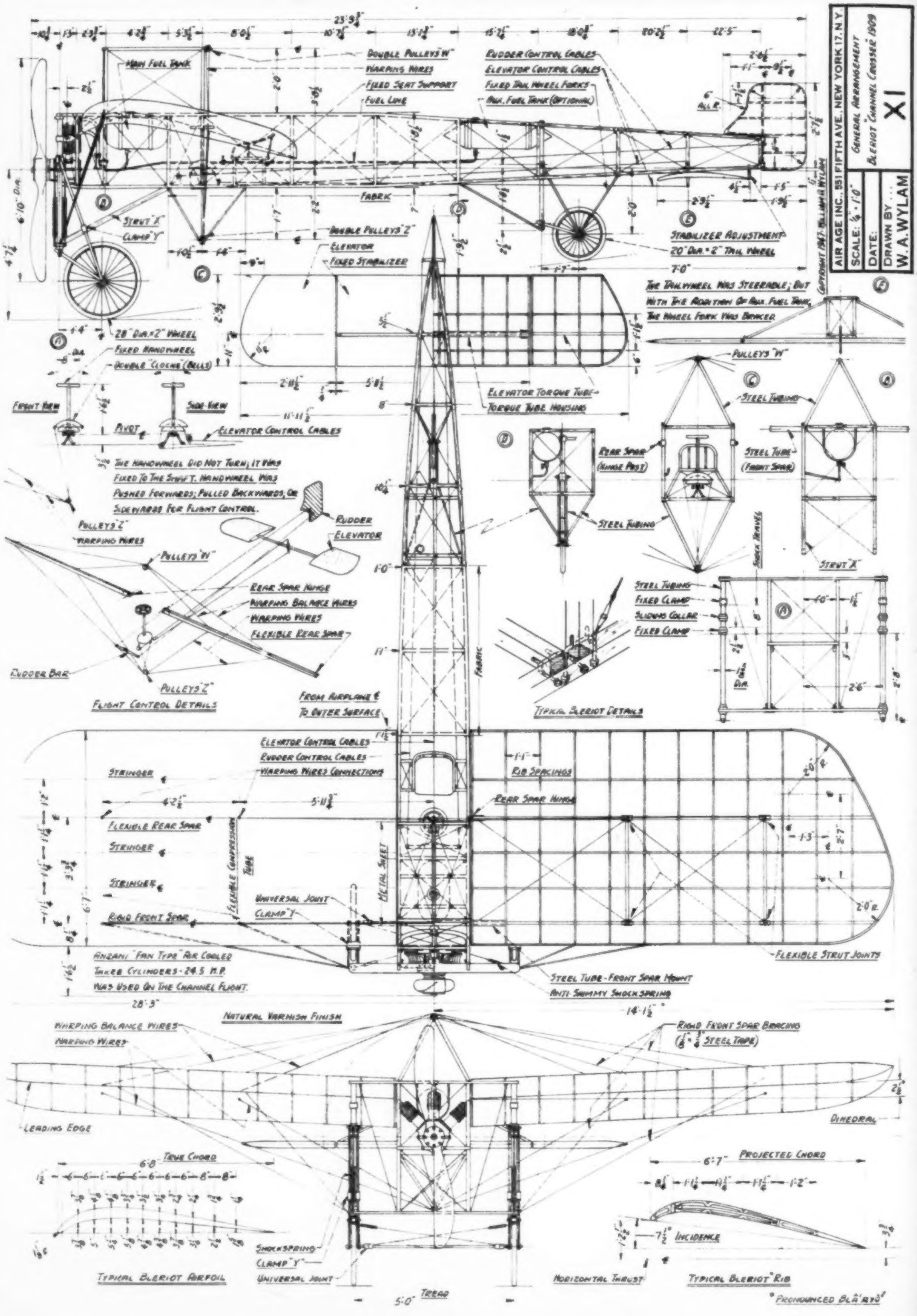
As it turned out, however, the centrally mounted fin—atop the fuselage—worked out okay. Our work with canards had misled us. For one thing we were now dealing with a symmetrical airfoil and the flow did not rise as high above the surface of the wing as with a conventional highlift section. *But* most important—the centersection never approaches the stall condition, due to the washed-in wing tips which stall first, and consequently result in a nosing-down action.

One other fact that startled us at first but which on examination proved logical: the center of lift and the center of gravity must be either coincidental or in the same vertical line.

Now if the wing is pushed up by a gust, the tips increase their lift only a little while the lift of the centersection increases greatly, moving the center of lift rearward and causing a nosing-down movement which returns the wing to steady level flight. So long as it remains this way, the lift of the wing is acting equal and opposite to the force of gravity. If the ship dives, the centersection reaches a negative angle of attack first and thus pulls down while the tips are still lifting, hence there is a nosing-up movement.

A low center of lateral area is still necessary for spiral stability. To accomplish this we bellied down the fuselage; used large diameter but thin wheels on a long landing gear. If no landing gear is used, some of the rudder area should be placed below the fuselage.

This type of wing has now been built as a towline glider, rubber job (both pusher and tractor designs were tried), and as a free flight gas job which was ultimately converted to a goat. All are stable, exceptionally strong, very fast. Undoubtedly the greatest possibilities exist in the control line field where the utmost in speed is desirable.


AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
GENERAL ARRANGEMENT
BLERIOT "CHANNEL CROSSER" 1909
XI
SCALE: 1/4" = 1'0"
DATE:
DRAWN BY W. A. WYLAM
COPYRIGHT 1947 - WILLIAM WYLAM
MAIN FUEL TANK
DOUBLE PULLEYS "W"
WARPING WIRES
FIXED SEAT SUPPORT
FUEL LINE
RUDDER CONTROL CABLES
ELEVATOR CONTROL CABLES
FIXED TAIL WHEEL FORKS
AUX. FUEL TANK (OPTIONAL)
FABRIC
STRUT "X"
CLAMP "Y"
DOUBLE PULLEYS "Z"
ELEVATOR
FIXED STABILIZER
STABILIZER ADJUSTMENT
20" DIA. × 2" TAIL WHEEL
THE TAILWHEEL WAS STEERABLE; BUT WITH THE ADDITION OF AUX. FUEL TANK, THE WHEEL FORK WAS BRACED
28" DIA. × 2" WHEEL
FIXED HANDWHEEL
DOUBLE "CLOCHE" (BELLS)
FRONT VIEW
SIDE VIEW
PIVOT
ELEVATOR CONTROL CABLES
ELEVATOR TORQUE TUBE
TORQUE TUBE HOUSING
PULLEYS "W"
STEEL TUBING
REAR SPAR (HINGE POST)
STEEL TUBE (FRONT SPAR)
THE HANDWHEEL DID NOT TURN; IT WAS FIXED TO THE SHAFT. HANDWHEEL WAS PUSHED FORWARDS; PULLED BACKWARDS, OR SIDEWARDS FOR FLIGHT CONTROL.
PULLEYS "Z"
WARPING WIRES
PULLEYS "W"
RUDDER
ELEVATOR
REAR SPAR HINGE
WARPING BALANCE WIRES
WARPING WIRES
FLEXIBLE REAR SPAR
RUDDER BAR
PULLEYS "Z"
FLIGHT CONTROL DETAILS
SHOCK TRAVEL
STRUT "X"
STEEL TUBING
FIXED CLAMP
SLIDING COLLAR
FIXED CLAMP
TYPICAL BLERIOT DETAILS
FABRIC
FROM AIRPLANE ℄ TO OUTER SURFACE
ELEVATOR CONTROL CABLES
RUDDER CONTROL CABLES
WARPING WIRES CONNECTIONS
RIB SPACINGS
STRINGER
REAR SPAR HINGE
FLEXIBLE REAR SPAR
STRINGER
STRINGER
FLEXIBLE COMPRESSION TUBE
METAL SHEET
UNIVERSAL JOINT
CLAMP "Y"
RIGID FRONT SPAR
FLEXIBLE STRUT JOINTS
ANZANI "FAN TYPE" AIR COOLED THREE CYLINDERS - 24.5 H.P. WAS USED ON THE CHANNEL FLIGHT.
STEEL TUBE - FRONT SPAR MOUNT
ANTI-SHIMMY SHOCKSPRING
NATURAL VARNISH FINISH
WARPING BALANCE WIRES
WARPING WIRES
RIGID FRONT SPAR BRACING (1/8" × 3/4" STEEL TAPE)
LEADING EDGE
DIHEDRAL
TRUE CHORD
PROJECTED CHORD
INCIDENCE
SHOCKSPRING
CLAMP "Y"
UNIVERSAL JOINT
HORIZONTAL THRUST
TREAD
TYPICAL BLERIOT AIRFOIL
TYPICAL BLERIOT RIB
*PRONOUNCED BLĀ'RYŌ'

DESIGN FORUM

BY F. M. TAYLOR

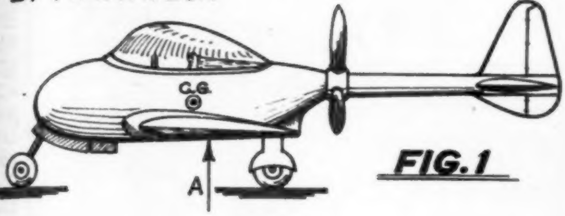
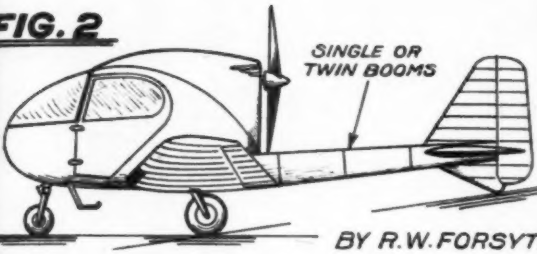


FIG. 1

FIG. 2



BY R. W. FORSYTH JR.

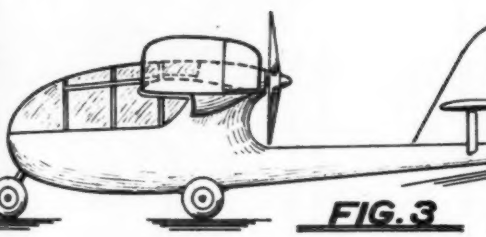


FIG. 3

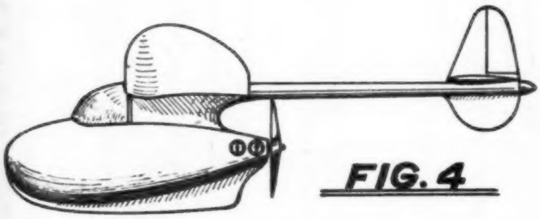
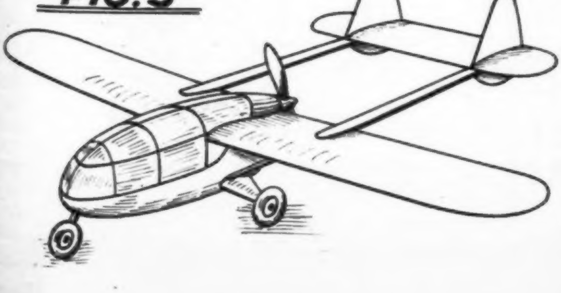


FIG. 4

FIG. 5



by CHARLES H. GRANT

MOST model builders hope, eventually, to fly their own full scale airplane. The young man usually begins his aviation career by visualizing himself taking wing in every large airplane he sees. He lives in the hope that he will be able to climb into the cockpit, grasp the stick and feel the craft respond to his every desire. Some, with funds and opportunity, have been able to fulfill this vision. The majority, however, are not so lucky.

Not to be denied the thrill of flight, they turn to model planes as the next best outlet for their flying urge. Yet they cling to the idea of some day owning their own airplane; and from time to time they attempt to put on paper designs of craft they would like to own.

For many months "Design Forum" has discussed the value of some of these designs submitted by readers. There has been a decided tendency in these designs to incorporate every desirable feature regardless of whether or not it can be carried out practically.

Usually an airplane is a compromise; it is impossible to incorporate everything desired. To obtain certain features others must be sacrificed; so the art of designing your own plane lies in your ability to draw, in the right place so to speak, a line between the desirable and undesirable factors. If you eventually intend to purchase your own airplane, greater satisfaction will result if you fully realize the advantages and disadvantages of various arrangements and construction. Perhaps you will better understand the factors involved and be able to choose more wisely if we discuss this matter.

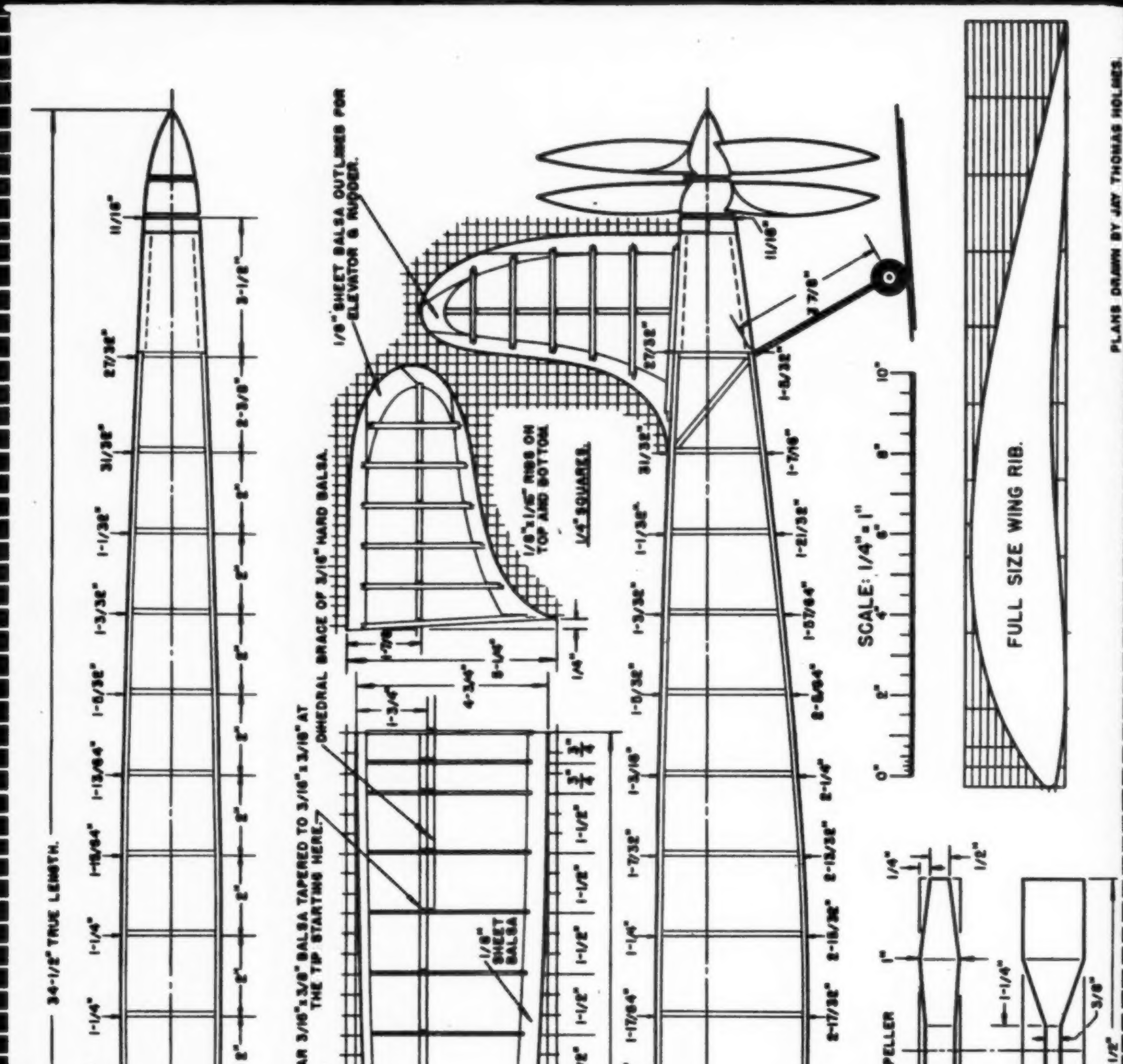
To sit down and draw a "pretty" airplane may satisfy your momentary creative urge but it seldom results in a practical design. The first step is to list every feature you would like your airplane to embody; then draw up your plane to include as many of these as possible. What are these features?

First is speed—you wish to get somewhere in a hurry When you get there you wish to land safely. The field may be rough, it may be small, or visibility may be poor; therefore to come in slowly and gently is safest and most desirable. So, besides speed, you want the airplane to land slowly. Your takeoff again requires power and a short takeoff run. In other words, the plane must leave the ground quickly.

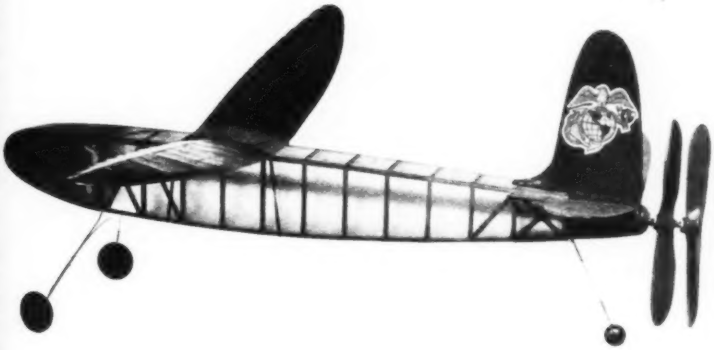
In windy weather great discomfort results if the plane does not fly steadily but bounces all over the sky in response to every air gust; or if the plane is thrown into some critical position from which it does not recover quickly. Perhaps a fatal maneuver such as a spin may result. Seldom are airplanes as unstable as this. Usually rough weather merely causes a harmless yet unpleasant feeling in the midsection.

"Wind gusts" is not the only cause of erratic flight. Often the airplane is what is known as critical. Unless careful attention is giving to flying it every minute it will seek some unstable flying attitude. In other words, the pilot must control the plane continually without relaxation. All this adds up to the need for a stable airplane, one that practically flies itself. In this the intelligent model builder is supreme because anyone who has flown models has had to build it so that it flies by itself without a pilot. It is natural, therefore, that certain features necessary for this steady flight in a model are incorporated in large aircraft. We may even venture to predict that in the future, when more stable full scale craft are built, *model builders* will build them. The

(*Turn to page 54*)


34-1/2" TRUE LENGTH.
1/8" SHEET BALSA OUTLINES FOR ELEVATOR & RUDDER.
DIHEDRAL BRACE OF 3/16" HARD BALSA.
SPAR 3/16"x3/8" BALSA TAPERED TO 3/16"x3/16" AT THE TIP STARTING HERE.
L. E. 1/4"x1/4" BALSA TAPERED TO FIT RIBS.
1/8" SHEET BALSA
1/8"x1/16" RIBS ON TOP AND BOTTOM
1/4" SQUARES.
MOUNT FRONT BEARING HERE.
1/16" DIA. PIANO WIRE.
1-5/8" DIA. WHEELS.
PROPELLER
SCALE: 1/4"=1"
FULL SIZE WING RIB.
PLANS DRAWN BY JAY THOMAS HOLMES.

baby MIXMASTER



by GEORGE KANAKOS

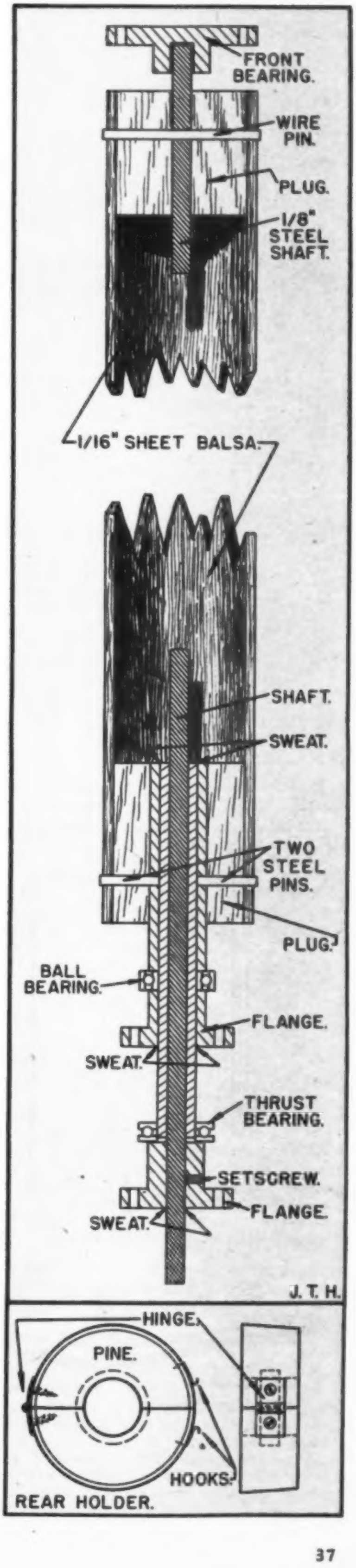
DO you want more speed plus stability and complete elimination of torque? Well, here is the answer in a contra-rotating prop arrangement for rubber powered models. As we all know, torque is an important factor in designing models. With torque eliminated, model building is a pleasure and flying is a greater pleasure. This model was designed after gaining experience on contra-rotating prop arrangements as applied to gas powered models.

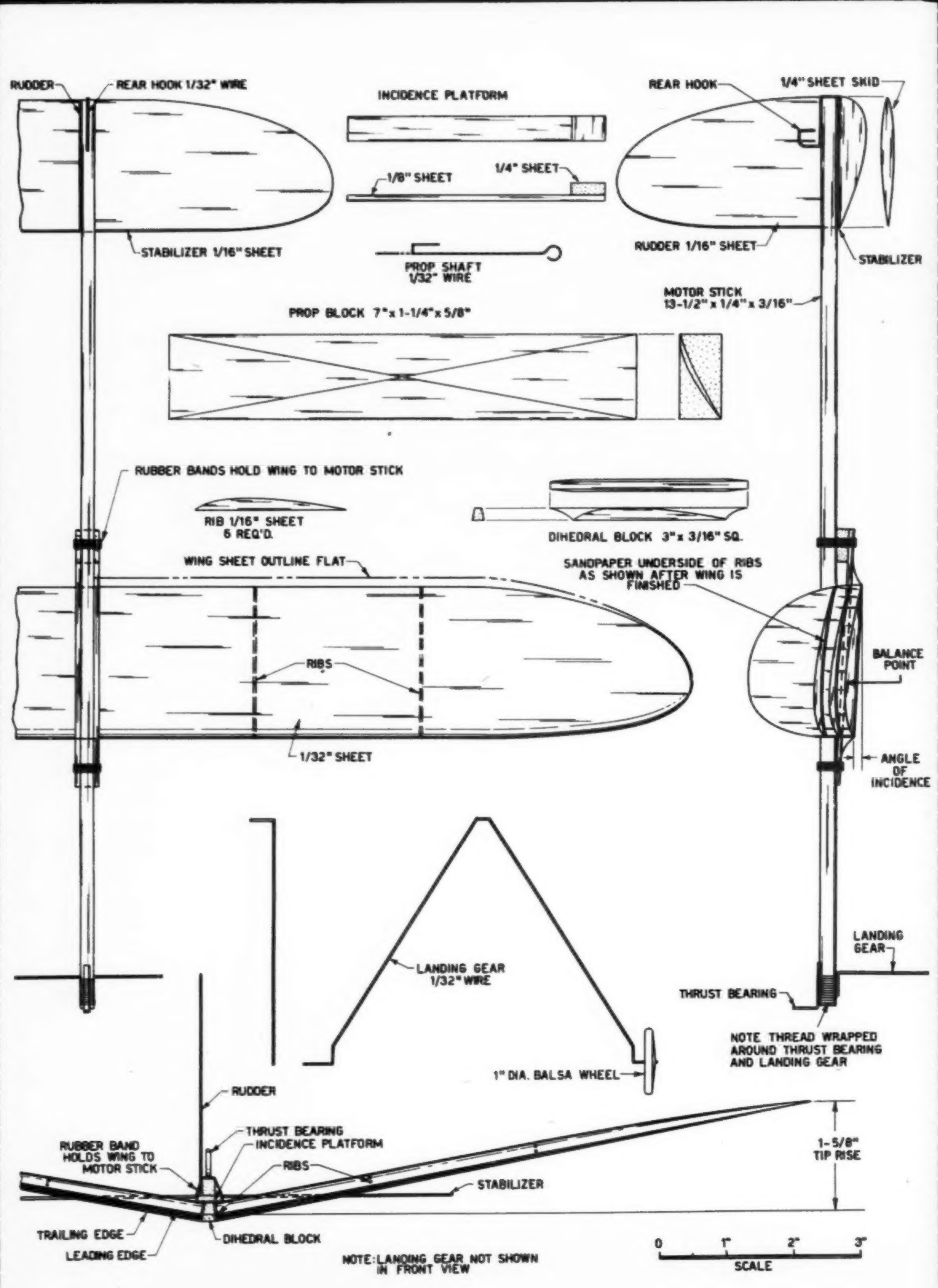
In designing this model and the contra-rotating prop arrangement, I had to contend with weight which I have kept to the minimum. The completed model weighs 5 oz. Taking into consideration the ball bearings, flanges, plugs and tubing, this is very light indeed.

Although this model was not designed for endurance, it is far from a short distance flyer as your test flights will prove. In three different tests, with only 150 turns, my model averaged over 200 ft. at about fifty feet altitude and flew in a very stable manner at high speed. Using 1/8" flat rubber (12 strands), maximum turns should be 200 and care should be taken not to exceed this limit until you are sure of your rubber. This model is of very simple construction and should give little trouble in building. The contra-rotating mechanism may appear a bit difficult, but upon closer examination you will find that it is a simple affair. All parts such as flanges, bearings, tubing and the shaft, which is 1/8" drill rod, are of standard make and can be purchased at low cost.

FUSELAGE CONSTRUCTION — Start in the usual manner by laying out the two sides and allowing them to dry thoroughly. Then remove from drawing board and add top and bottom crosspieces as shown on drawings. The dimensions at each station, both on side and top views, show the distance from outer edge of the longeron to centerline of the fuselage. Thus, to get the full size for the uprights, add the dimensions on top and bottom and subtract double the thickness of the longerons. The next step is to shape a nose block as illustrated from solid stock. The tail block is carved in same manner as nose block, and both are sanded to a fine finish. Hollow out both blocks to approximately 1/4" wall. Glue bulkhead

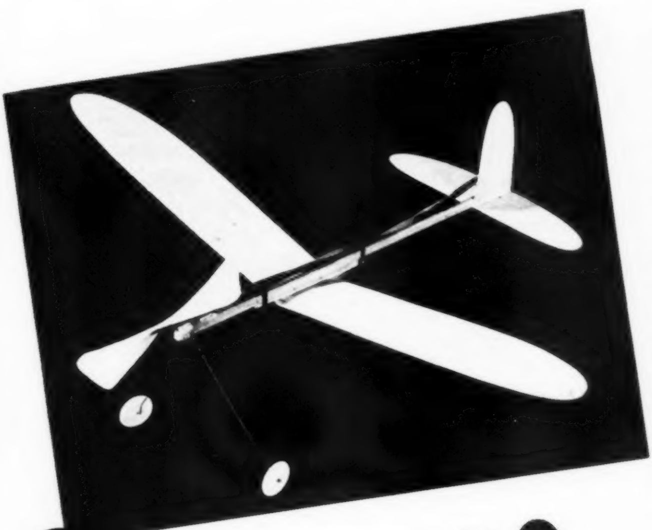
(*Turn to page* 65)

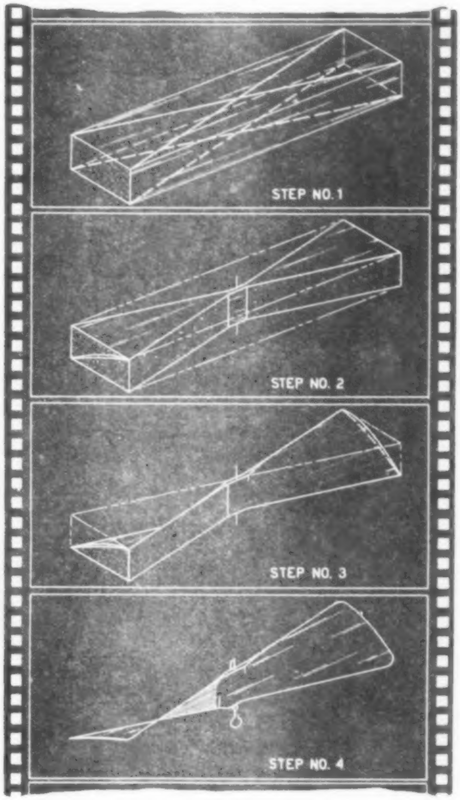



RUDDER
REAR HOOK 1/32" WIRE
STABILIZER 1/16" SHEET
INCIDENCE PLATFORM
1/8" SHEET
1/4" SHEET
PROP SHAFT 1/32" WIRE
REAR HOOK
1/4" SHEET SKID
RUDDER 1/16" SHEET
STABILIZER
MOTOR STICK 13-1/2" x 1/4" x 3/16"
PROP BLOCK 7" x 1-1/4" x 5/8"
RUBBER BANDS HOLD WING TO MOTOR STICK
RIB 1/16" SHEET 6 REQ'D.
DIHEDRAL BLOCK 3" x 3/16" SQ.
WING SHEET OUTLINE FLAT
SANDPAPER UNDERSIDE OF RIBS AS SHOWN AFTER WING IS FINISHED
RIBS
1/32" SHEET
BALANCE POINT
ANGLE OF INCIDENCE
LANDING GEAR 1/32" WIRE
LANDING GEAR
THRUST BEARING
NOTE THREAD WRAPPED AROUND THRUST BEARING AND LANDING GEAR
1" DIA. BALSA WHEEL
RUDDER
THRUST BEARING
INCIDENCE PLATFORM
RUBBER BAND HOLDS WING TO MOTOR STICK
RIBS
STABILIZER
1-5/8" TIP RISE
TRAILING EDGE
LEADING EDGE
DIHEDRAL BLOCK
NOTE: LANDING GEAR NOT SHOWN IN FRONT VIEW
0
1"
2"
3"
SCALE

MODEL AIRPLANE COURSE FOR BEGINNERS

A CAREFULLY PLANNED AND TESTED SERIES OF ARTICLES FOR BEGINNERS IN THE ART OF BUILDING AND FLYING MODEL PLANES





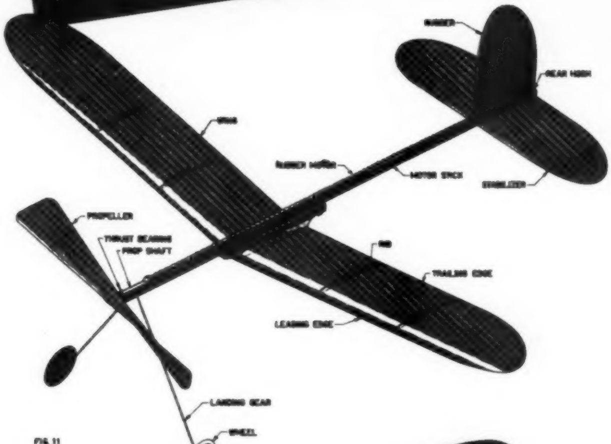


FIG. 11

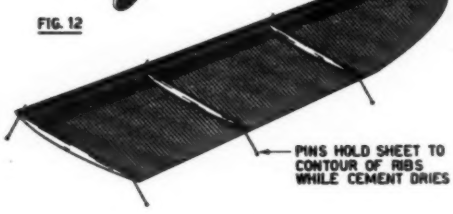


FIG. 12

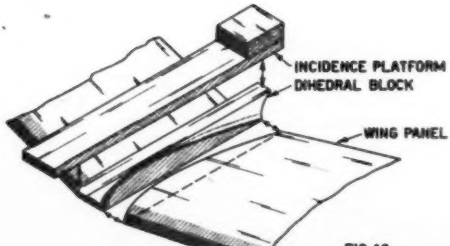


FIG. 13

LESSON 3—Build and Fly An All Balsa R.O.G.

THE model presented in this lesson is designed primarily to advance our technique in construction, and it illustrates the simplicity with which outstanding flight performance can be obtained.

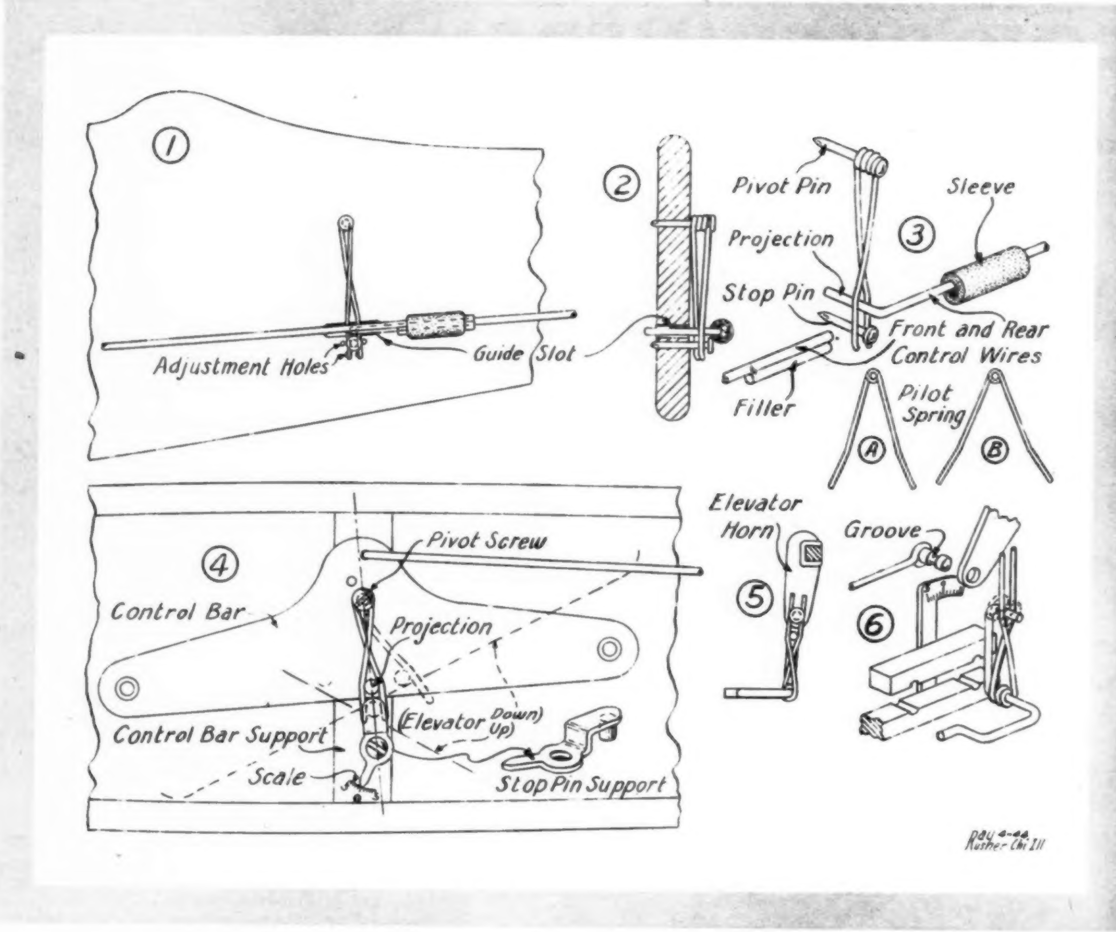
Generally referred to as an R.O.G. (Rise Off Ground), the craft, Fig. 11, is an all balsa stick model, equipped with a landing gear, rubber motor and propeller. This is the simplest form of self propelled flying models.

Materials Required. 1. A piece of hard strip balsa 13-1/2" long x 1/4" thick x 3/16" wide—for the stick, or fuselage.

2. Two pieces of 1/32" thick sheet balsa, each 2-1/2" wide and 9" long—for the wing panels.
3. A piece of 1/16" medium hard sheet balsa 2" wide—for the ribs, rudder and stabilizer.
4. A short strip of 3/16" sq. hard balsa for the dihedral block.
5. A small sheet of 1/8" thick hard balsa—for the incidence platform.
6. A small sheet of 1/4" hard sheet balsa—for the incidence platform and skid.
7. A medium hard block of balsa 7" long x 1-1/4" wide x 5/8" thick—for the propeller.
8. A pair of 1" dia. balsa wheels. (These are optional; the builder may wish to make them of 1/4" sheet.)
9. A length of 1/32" dia. music wire—for landing gear, prop shaft and rear hook.
10. A small propeller bearing.
11. A length of 1/8" flat rubber about 26" long.
12. A small bead or 2 washers—to be inserted on the prop shaft.
13. A small tube of model airplane cement.
14. A short length of thread.

Tools Required. 1. A sharp knife; 2. razor blade; 3. a long nose pliers; 4. wire cutting pliers or snippers; 5. package of varied sandpaper; 6. ruler; 7. pencil; 8. scissors; 9. pins. With the exception of the long nose pliers and wire snippers, which will be used to form the wire parts for our model,

(Turn to page 42)



AUTOMATIC PILOT FOR U CONTROL

by RAY RUSHER

MOST U-Control flyers are familiar with the type of automatic pilot consisting of two rubberbands opposing each other, which theoretically positions the control bar at "neutral" to keep the plane level when the wind blows it toward the flyer and thereby slackens the flying wires.

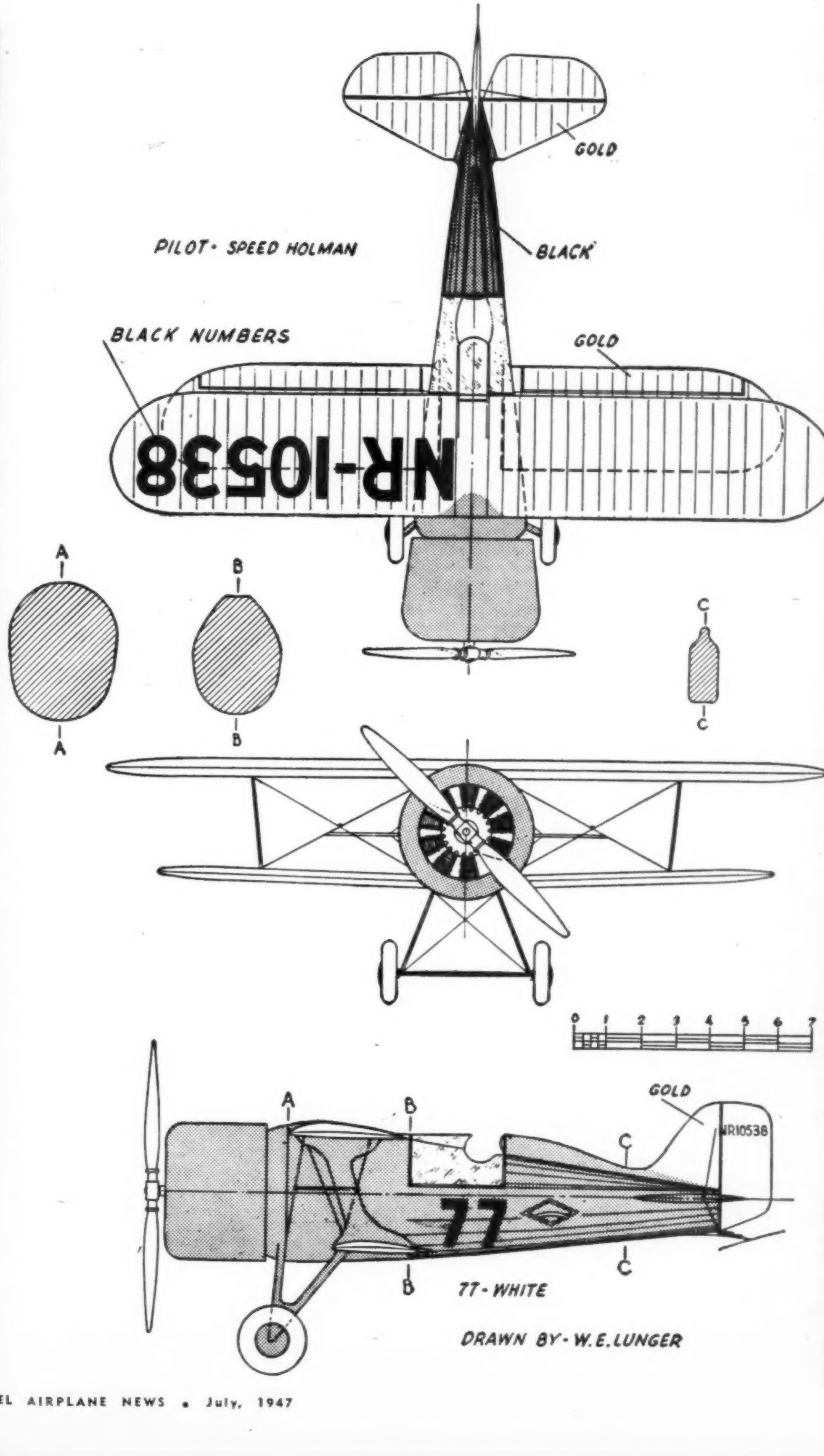
Auto-pilots of this character depend on a delicate balance at neutral position, and any friction in the elevator hinges, control bar pivot or guides for the control or flying wires is reflected in the control bar failing to return fully to neutral position when the bar or elevator is moved in one direction or the other and then released. Furthermore, it takes very little pressure to move the control bar from neutral position. It is evident that if a preloaded pilot spring can be devised having a definite stopped position against movement in both directions, an exact neutral position of the elevator would be assured and it would take considerable force to move it from this position.

The accompanying drawing illustrates several ways in which this can be accomplished: (1) and (2) showing a side view and a section of Jim Walker's Whip Power *Airacobra* with the auto pilot installed; (3) a perspective of the pilot and parts of the control wire; (4) an installation on the control bar; (5) pilot working direct on elevator horn; and (6) a perspective of (5).

Essentially, the auto-pilot consists of a pilot spring, a pivot pin, a stop pin, and a projection from some part of the elevator control system to be engaged by the pilot spring. The pilot spring is a double arm affair, and the stop pin definitely stops one of these arms in one direction and the other arm in the opposite direction. The initial shape to which the pilot spring is formed can be such as to secure any desired degree of preloading; For example: shape (A) for light preloading and shape (B) for heavy. The diameter of the wire, length of the arms, and number of coils around the pivot pin determine the rate of spring pressure build-up as either arm is moved away from the

(*Turn to page* 53)

LAIRD SOLUTION 1930



Model Airplane Course for Beginners

(*Continued from page 39*)

the rest of these tools are similar to those used in constructing the previous model.

Constructing. Detail plans and layouts of the model are furnished. These you will note are drawn 1/2 size of the finished model. Because of this, it will be necessary to vary the transfer procedure from that to which we have become accustomed in the two former lessons. Inasmuch as it is desirable to understand the method of working from "scaled down" plans (plans showing the model smaller than its full finished size), we shall assume that you are not enlarging the drawing to full size (photostatically or by any other photographic means) and will work directly from the furnished plans. Note the scale at bottom right hand corner of the plans. The distance designated one inch on the magazine plans actually measures 1/2 inch on your ruler. Therefore, the model as shown in the drawing is 1/2 the size of the finished craft. Bearing this in mind, any measurements taken from the drawing (except that indicated for the tip rise) must be multiplied by two in transferring the outline of the various parts from the plans to the balsa.

Fuselage. As the fuselage consists only of a hard balsa strip 1/4" thick x 3/16" wide, the only operation required is to cut it to the required length of 13-1/2". If desired, the upper surface may be sanded slightly, eliminating the sharp edges. The bottom surface, however, must be left perfectly flat in order to properly "seat" both the stabilizer and the wing assembly. At this point, a small thrust bearing (an "L" shaped flat wire fitting used to support the propeller shaft) may be cemented to the upper surface of the nose end of the balsa stick. (The thrust bearing is available at your local hobbycraft dealer's shop or it may be made from a strip of flat metal with a small hole in it for the propeller shaft.)

Tail Surfaces. As indicated in the list of materials, the tail surfaces are made of 1/16" balsa sheet 2" wide. A strip 3-1/4" long is required for the rudder, a 7-5/16" length for the stabilizer. After the balsa sheet has been cut to the desired lengths, the curved outline of the stabilizer tips and top of the rudder must be shaped as indicated.

As the curve for the stabilizer tips and the rudder top is identical, only a single template or pattern need be used. Draw the curve on stiff paper. After the paper pattern is cut out, lay it onto the tail surfaces and trace the outline with a soft pencil. Then use a razor to trim away the excess balsa, after which 2/0 sandpaper is used to finish the operation. The leading and trailing edges of both surfaces are then sanded slightly to form a half-round section.

Wing. The wing consists of several different parts that must first be completed individually and then assembled. The wing basically consists of two 1/32" thick sheet balsa panels, each 9" long and approximately 2-1/2" wide. These must first be cut to size and proper outline shape. The procedure for shaping the wing tips is identical to that used for the tail. Note that the tip curve starts outboard (outside) of the outer rib location. After the tips are shaped, sandpaper the top surface of the sheets lightly in order to increase the flexibility of the panels to the point where they will easily follow the shape, or contour, of the ribs.

The ribs, as one may guess, are used to hold the thin sheet balsa panels in a predetermined form or camber. A total of 6 ribs are used—3 in each panel. These are made of 1/16" thick sheet balsa. Each rib measures 2-1/4" in length and about 3/16" in height. The curved portion is such as to maintain the maximum rib height of 3/16" about one-third back from the leading edge. When the ribs have been completed, cement them to the wing panel sheets as shown in Fig. 12.

In order to make a really workmanlike job of this, it is advisable first to draw faint pencil lines on the sheet panels to indicate rib locations; then proceed to cement the ribs into place. In the cementing process, experience has indicated it

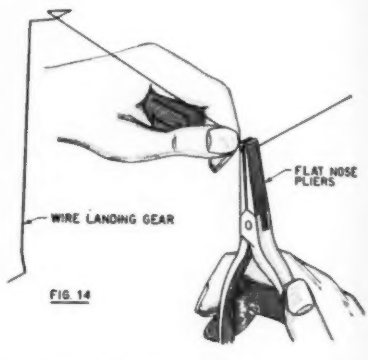


FIG. 14

advisable first to glue only a portion of the ribs to the panels—allow the cement to harden and then proceed with the balance of the operation. This means that we first cement the rear or trailing portion of the ribs to the sheet, refraining from curving the panels around the high point of the ribs until the cement has dried. Pins may be used to assist in holding the sheet panels to the rib contour until the cement is hard.

To form the dihedral angle in the wing in order that our model possess desired characteristics of stability in flight, a dihedral block is made and cemented to the inboard rib (rib farthest away from the wing tip) of each panel.

The dihedral block as indicated in the drawings consists of a 3/16" sq. strip measuring 3" long. The strip is tapered so that the top surface measures just slightly under 1/8" in width, while the bottom surface remains at 3/16". The small amount of taper required can be achieved by sanding the block sides. In addition to the taper, the front and aft ends of the block must be sandpapered to the required shape.

Before the dihedral block is cemented to the wing panels, the incidence platform must be made and cemented into position atop the block. The incidence platform consists of a 1/8" thick strip of balsa 3/8" wide and 3-7/8" long, with a piece of 1/4" thick balsa 3/8" wide and 1/2" long cemented to the aft end. The purpose of this platform is to maintain the wing in a fixed position with the trailing edge dropped considerably below the leading edge, as shown in the side view of the detail drawings.

The fixed angle formed by the bottom of our wing ribs and the line of thrust (in this case a horizontal line parallel to the fuselage stick) is known as the "angle of incidence." Incidence is used to increase the lifting capacity of our wing.

With the major parts of the wing com-

(*Turn to Page* 45)

With this issue
MODEL AIRPLANE NEWS
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pleted, we have only to cement them together to complete the wing assembly. Fig. 13 illustrates, in "exploded" form, the general arrangement of the wing details in relation to each other.

In assembling the wing, several important details must be carefully checked if topnotch performance is to be attained. First, you must make certain the lower surface of each inboard rib is parallel to the lower surface of the dihedral block longitudinally (fore and aft) in order to maintain identical incidence angle for both panels; second, that the tip rise is the same at each wing tip. When these points have been checked, examine the position of the incidence platform. The 1/8" sheet balsa base should be parallel to the bottom surface of the dihedral block in a lateral (left to right) plane in order to maintain the set dihedral angle upon attaching the wing to the motor stick.

After completing the wing, if the modeller desires, the two outer ribs of each panel may be lightened by sandpapering the under surface to conform to that shown in the side view drawing of the model.

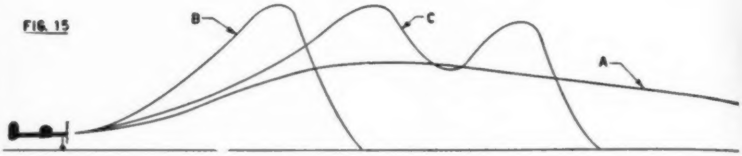
Propeller. The propeller is carved from a piece of balsa, 7" x 1-1/4" x 5/8". Detail procedure for making the "prop" is best illustrated by the accompanying film strip. As shown in the first frame and in the detail drawings, we mark the outline of the prop on the wood block. In addition to drawing a connecting line between each corner on the face of the block to that diagonally opposite, two parallel lines are drawn at the midpoint area to indicate hub thickness. (In our case about 1/8" thickness is maintained.) The entire procedure is then repeated on the aft surface of the block. A small hole for the prop shaft is made at the point of intersection of the diagonal lines. The hole may be drilled or can be made by heating a short end of the 1/32" music wire red hot and pressing it into the balsa. When this is done, whittle away the excess balsa outside the pencilled lines and finish off the "cut" with sandpaper, so that the prop blank resembles that shown in the second frame of the film strip.

Our next step is to whittle and sandpaper away the excess balsa from the propeller blades, leaving only a thin section with convex form in front and concave surface aft indicated in step 3 of the film strip. As seen from an end view, the section should resemble an airfoil as shown in our film strip sketches and detail drawings. After this is done, round the corners of the blades slightly with 2/0 paper as shown in the last frame. Care must be taken to keep the propeller blades of identical size, weight, thickness and shape if good flight results are to be had.

Wire Parts. All wire parts are formed of 1/32" music wire. These include: landing gear, propeller shaft and rear hook. A front and side view of the landing gear is furnished. Using these details and the sketch, Fig. 14, the landing gear is formed with the aid of small flat nose pliers from a strip of wire 10-7/16" long. Rear hook and prop shaft are formed in a similar manner unless the builder chooses to purchase these parts readymade.

Assembly. Assembling the model at this point is an easy matter. First, cement the stabilizer to the bottom surface at aft end of the motor stick, making certain to have it centered properly. Next, slip the rear hook into position over the motor stick and around to the bottom surface of the stabilizer. Applying cement liberally, we

FIG. 15



permit it to harden and form a skin over the hook and motor stick. Now the rudder may be cemented to one side of the stick directly over the stabilizer.

While the cement is drying, you can cut and shape the 1/4" thick skid which must be glued beneath the stabilizer. This is used primarily to save the horizontal tail surface from damage on landings; it may therefore be of hard balsa. Sandpaper it to a smooth streamline shape so it will cause little resistance.

Assembling the landing gear to the forward end of the stick should offer no difficulty. Apply cement and wrap thread tightly around the gear, motor stick and thrust bearing to assure a strong, lasting assembly. Additional cement is applied and allowed to form a skin around the thread, preventing loose ends from pulling out.

A pair of 1" diameter wheels are slipped onto the landing gear, and a drop of cement applied to each axle end to prevent them from falling off. Care, of course, is taken to see that the wheels can roll freely and that they do not bind on the axle.

The wing is held to the motor stick by loops of 1/8" flat rubber wrapped tightly around the motor stick and incidence platform as illustrated in the drawings.

Our next step is to slip the propeller shaft through the thrust bearing; slip a small bead or several washers onto the shaft in front of the bearing and insert the straight end of the shaft through the hole in the prop hub. With the long nose pliers bend the front end of the shaft as shown in the drawings, and insert the newly formed hook end into the prop. Apply sufficient cement to form a skin around the hub and to prevent the shaft from coming loose.

Powerplant. The only motive power in our model is that furnished by a single loop of 1/8" flat rubber about 13" long. At the forward end it is fastened to the prop shaft; at the aft end it is engaged by the rear hook.

Balance. Like the gliders in our previous lessons, the little stick model must be properly balanced and adjusted for successful flying. As the position of the wing in this model is not fixed, balance is achieved by moving the wing along the motor stick until the model balances at a point about one-third back from the wing leading edge. After this is done, recheck the various surfaces for proper alignment. Each surface must be in the required plane illustrated by the drawings, and completely free from twists or warpage. Once we are certain of satisfactory alignment we proceed to gently test glide the craft as a further check on correct balance.

Like the gliders, our R.O.G. model must be launched gently into the air from about eye level altitude with its nose pointing slightly down. As this is an indoor flyer, we need not worry about prevailing winds. Our only concern is to eliminate any obstacles within the flying area. When released, the craft will glide gently to the floor along a long, flat graceful curve or flight line—*provided the balance point is correct and the surfaces are free from warpage.*

If the glide is not as satisfactory, but proves to be too speedy and short, in all probability the wing is too far back and must be moved forward. On the other hand, if the wing is too far forward, the model will zoom upward only to lose gliding speed, then drop to the floor in a fast steep glide.

After a proper balance has been achieved by test gliding the craft, the modeller should develop his launching technique by further practice glides. The correct method for holding the craft on launching is to grasp the stick or fuselage between your thumb and index finger just behind the wing. When gliding the model, your left hand is free (if you are right handed). In powered flight, the left hand is used to hold the propeller blade until the ship is ready to be released.

Flying. With all the preliminaries over, we are now ready for the first flight. Caution is required at this point, because it may be necessary to make slight additional adjustments for powered flight.

Hold the motor stick firmly in the left hand as close to the thrust bearing as possible; with the index finger of the right hand turn the propeller clockwise until the rubber motor has absorbed about 175 to 200 turns. Now lift the model to about eye level, holding the propeller with the left hand at the tip nearest the ground, and the stick between thumb and index finger just behind the wing.

Do not throw the model up on launching; it need only be propelled straight forward at gliding speed after the propeller is released and spinning freely. On the other hand care must be taken not to merely drop the model—it must be given an initial start when hand launched. Also, it is necessary first to release the propeller and then the model. Do not release both simultaneously.

On being released, the model will fly forward until sufficient speed has been gained; then it will climb gently while the rubber uncoils. Near the end of the uncoiling process the model loses power, gradually levelling off and gliding gently to the ground. The desired flight path is illustrated by line "A" Fig. 15. With sufficient power in the motor, in addition to following the illustrated flight path, the model may tend to circle gently to the left.

If, during the first flight, the model follows path "B"—zooming skyward only to lose forward speed and fall steeply to the ground—check the stabilizer for warpage and check your launching technique to make sure you haven't thrown the model forward, with too much force on launching. Should the trailing edge of the stabilizer be curved up, it will be necessary to warp it back into line. Additional flights should then be attempted and unless the model performs as desired, warp the trailing edge of the stabilizer down slightly. (If warped down too much, the surface will over-control, preventing the model from climbing, and may even result in a short dive.)

Flight path "C" illustrates the effect of placing the wing too far forward. In this event, move the wing aft slightly. If traces of this erratic behavior persist, it may be necessary to sandpaper the incidence

WORLD WAR I FANS

The August issue of MODEL AIRPLANE NEWS will contain the first in a series of WYLAM Masterplans on the German PFALZ D3 fighter, together with Bob Hare's authentic notes on this ship.

platform block to less than 1/4" thickness, thereby decreasing the incidence angle and reducing the lift of the wing. This will only be necessary, however, if the 1/4" thick block has been made slightly thicker than called for, or if the cambered surface of the ribs is greater than required (ribs more than specified 3/16" height).

In addition to hand launched flights, the craft may be permitted to take off the ground unassisted. After sufficient successful flights have been achieved, additional power may be added to the motor. The number of turns ultimately absorbed depends on the type of rubber used, its age, and the courage of the builder. This, along with warpage of the control surfaces for flying the model in predetermined maneuvers, is best left to the individual, for only through such experience will he attain sufficient skill and advance to the next stage of his career.

* *

Digging into our mailbag this month, we find this pertinent question submitted by Ralph Stewart of Plattsburg, N.Y.:

QUESTION: What is the difference between "angle of attack" and "angle of incidence"?

Answer: As described in this lesson, "angle of incidence" is the angle formed between the wing chord line (in the above case a straight line from leading to trailing edge of the wing or base line of the rib) and the line of thrust (the line assumed by the propeller shaft as the prop spins). "Angle of attack" is that angle formed between the wing chord line and the line of flight. If the line of flight is parallel to the line of thrust passing through the center of the prop shaft, "angle of attack" and "angle of incidence" are the same.

Robert Stern of Fall River, Mass., asks:

QUESTION: Are gas engines and rubber motors the only types of powerplants available for models?

Answer: No. As in full scale aircraft, models are also powered by Diesel engines and jet propulsion systems. In addition to these, compressed air motors and CO_2 (carbon dioxide) powered units are available.

* *

Look in on us next month when a lighter "built-up frame" endurance flyer is presented in Lesson 4. Meanwhile, you are invited to send your questions along with photographs and news of your model building and flying experience during the course of these lessons.

Curtiss Seahawk

(*Continued from page 27*)

pants as shown and glue in position. Add plastic wood fillets and sand smooth when dry. Add the wheels last.

PAINTING—The original model was sprayed completely silver except for top of upper wing, which is yellow. Rudder and cowl are red. Black detail and lettering are added later when model is complete.

FLYING—Adjust the model for a smooth hand glide. Wind to 50 or 60 turns and see how she behaves. Now wind 150 to 200 and watch for any stalling, correcting this tendency with downthrust. After stable flight is obtained, give the motor 300 to 400 turns and watch her go!

World War I

(*Continued from page 22*)

ter-cooled vertical type normally rated at 210 hp but actually delivering 225 hp at 1700 rpm. Initials of its manufacturer — Societa Piemontese Automibil — gave the engine its name.

Altogether, six models of the basic S. V. A. design illustrated here are known to have been put through flight testing. Of these, three were exclusively single seat fighters, two were listed in Italian records for "escort" purposes and were primarily long range fighters, while one adaptation was fitted out as a single seat bomber. In addition, two variations on the original design were made and known as the "Primo" and the "Balilla." Both were single seat fighters. Of all these types, most of which were experimental, only the S. V. A.-4 bomber and one single seat fighter, S. V. A.-5, reached true production status.

In the discussion that follows, the -4 and -5 types will be described as one ship except where minor differences occur.

Design Background

Primary consideration in the development of the first production type, S.V.A.-4 single seat bomber, was the area over which it was required to operate. Effective air raids on Italy's primary enemy, Austria, required aircraft with unusual range. And as though it was not enough to have to fly a long way, the intervening Alps and Apennines, which geographically separate Italy from Europe, had to be flown over. Early Italian raids on such choice targets as Munich and Vienna were hardly effective. Military encampments on the Austrian side quickly reported any Italian aircraft seen struggling through the mountain passes. Raid warnings and eventual interception short of the target was the fate of too many bombing expeditions to make them militarily effective. The big requirement, then, was a fast long range light bomber relying on both its speed and self defending qualities for protection.

Early in 1917 engineer Verduzio met with Brezzi and the Perrone brothers to discuss his ideas for such an airplane. The ship he sketched and described raised eyebrows, to be sure, for it was entirely contrary to the accepted notion of a bombing plane. Verduzio proposed a small single seater powered by the then new S. P. A. 210 hp engine, generally featuring a low coefficient of drag, fairly high wing loading and a low power loading. It would be fast, possess a long range and still carry a fair load of bombs. Three experimental models were built early in 1917, each an improvement over the previous one, until the S. V. A.-4 satisfied Verduzio. The bomber's performance was so unusual that the basic design was immediately modified as a single seat fighter, identified as the S. V. A.-5. The -4 entered production in the summer of 1917, followed a couple of months later by the -5 pursuit. Identical in design and appearance, these two airplanes were the backbone of Italy's home-grown air fleet, and by the end of the war had almost entirely replaced Allied types of the same class in Italian service.

Construction

Besides being a skillful and practical engineer, Verduzio prided himself on his ability to effect production economy and speed through product simplification. He produced, as a result, one of the simplest military designs ever to take the air. Both fighter and bomber versions spanned

30′ 2″ in the upper and 25′ in the lower wings. Chord of both wings was 5′ 5″ and wing area totaled 263 sq. ft. Overall length of the two ships was the same—26′ 7″.

Upper wings were made in two panels joined together directly over the fuselage centerline. The right- and left-hand lower panels attached to the fuselage at the lower longerons. Both wings were of the conventional two spar with ribs combination, but the airfoil was unusually thin and provided with a shallow cambered lower surface and upturned trailing edge. At high speeds the trailing edge tended to flatten out, decreasing drag. In this manner Verduzio was able to get a mild "flap" effect which enabled the S.V.A. types to take off and land slowly with heavy loads, yet attain high speeds. Unbalanced ailerons were fitted in the upper wing.

Interplane bracing struts were streamlined steel tubing arranged in the form of a Warren truss when viewed from the front. The truss absorbed all lift and landing stresses and eliminated the usual cables. Each strut bay was wire braced within itself to preserve incidence, but there was no bracing between the bays. Centersection struts also were made of streamlined steel tubing. The front pair of struts on the -4 bomber converged at the front spar, their lower ends entering the engine cowl and terminating at fittings within the fuselage. Rear struts were in the form of right- and left-hand "vees," outwardly splayed, their upper ends joined at the rear spar slightly outboard of the fuselage. Fighter centersection struts also were inverted "vees" viewed from the front, their upper ends attached to the front and rear spars where the wing panels joined. Their lower extremities straddled the fuselage top contour to terminate in fittings attached to the upper longerons.

Trailing edge of the bomber upper wing was cut out to the rear spar over the cockpit, but in the -5 fighter this feature was not always incorporated and was presumably made as an afterthought in later production fighter models.

Fuselage

Most unusual feature of the S.V.A. fuselage was the manner in which its crossection was changed from rectangular in front to triangular behind the cockpit. Basic structure of the fuselage was a simple arrangement of wood longerons and struts to which a thin three-ply wood covering was nailed and screwed. Upper longerons were conventional in form, but lower members were brought together just behind the cockpit and spliced to a single longeron which continued to the sternpost. Exact reasons for this construction are not on record, but it would appear that Verduzio was able to save quite a few pounds in weight though at the expense of introducing an unusual tail flexibility which will be mentioned under "Performance Characteristics."

The fuselage upper deck forward of the cockpit consisted of a louvered sheet aluminum cowling completely covering the engine and preserving the nose radiator shape aft. Engine exhaust was led out the right side of this cowl through both short stacks and collectors. A long, formed headrest of plywood which gradually flattened out toward the tail streamlined the upper deck. A large stamped steel girder-type fitting bolted near the rear of the fuselage served to stiffen the body as well as to carry the tail skid. The skid itself was another

Verduzio innovation — a steel leaf-type spring.

A simple steel tube landing gear was attached directly to the lower longerons and carried a full axle sprung on rubber shock cord. Both S. V. A.-4 and -5 types came from the factory equipped with streamlined aluminum helmets covering the shock absorbing system, but these were soon discarded by mechanics who continually had to remove dents from them.

Empennage of the two planes consisted of conventional stabilizers with movable rudder and elevators of unbalanced design. The horizontal stabilizer was strut-braced on its underside to the tail skid fitting and the fin was wire braced to the stabilizer.

Armament of the -5 fighter consisted of two Vickers guns mounted outside on either side of the cowling just forward of the cockpit. Bomber armament, if it was carried at all, was a single Vickers similarly mounted on the right side.

Performance Characteristics

In his serious attempt to produce a fast, light, standardized airplane, Verduzio was rewarded with a ship with unusual performance. The -4 bomber weighed 1496 lbs. empty and 2292 lbs. loaded. The useful load included 200 lbs. of bombs, 75 gals. of fuel, the pilot and additional miscellaneous items. Empty and loaded weights for the -5 fighter were 1411 and 1984 lbs. respectively. Its 573 lb. load included 38 gals. of gasoline, the pilot and complete armament.

Official performance figures for the bomber at the above gross weight credit it with a top speed of 136 mph at sea level, a climb to 10,000 ft. in 10 minutes flat and to 20,000 ft. in a shade over 28 minutes. Corresponding figures for the fighter show a sealevel top speed of 143.7 mph, climb to 10,000 ft. in 8 min. 10 sec. and to 20,000 ft. in 22 min. flat. Landing speed of both types varied between 40 and 45 mph, depending on how much the airfoil had flattened out in use, and the landing weight.

In the air, both planes were light on the controls and possessed excellent maneuverability but had to be flown all the time because of an inherent instability on all axes. They spun easily but could be recovered quickly. Depending on the loading, they stalled with varying suddenness but at very high angle of attack. During tight maneuvers the empennage warped noticeably, even to ground observers, but with no ill effect. In a fast roll the wings actually returned to horizontal before the stabilizer did due to the flexibility of the fuselage! The takeoff of an S. V. A. machine also was unusual: the tail never left the ground. The ship simply gathered speed on three points and when it was going fast enough to fly —it started to climb!

Operationally, the S. V. A.-4 and -5 were a distinct success. Nearly all Italian pursuit squadrons were fitted with the fighter version toward the War's end while four bomber squadrons were entirely -4 equipped. They regularly took on the task of bombing Munich or Vienna, a round trip of about 700 miles. These missions were completed in less than seven hours! Because of their versatility the -5 fighters often were fitted with bombs for shorter range work and with extra fuel to escort the bombers.

The S. V. A. team—the planes and the men behind them — was a formidable weapon deserving of an everlasting place in aviation's hall of fame.

Automatic Pilot for U Control

(*Continued from page* 40)

stop pin, and of course this rate is equal for both arms. The author has found piano wire in sizes .015" to .019" suitable, depending on speed of the plane, size of the control surfaces, desired degree of resistance to control handle movement, total distance of travel of the projection, etc.

The stop pin is preferably adjustable to position the pilot spring so that the neutral position of the control bar will be had when the elevator is in exact alignment with the stabilizer, or possibly at a slight up or down angle as may be found suitable from flying or gliding tests. Such tests may be made by first adjusting the elevator to line up with the stabilizer and gliding the plane to see if there is any tendency to lose elevation or climb. The stop pin can then be readjusted in small increments to correct the tendency. Finally, recheck by flying the plane and slackening the flying wires; readjust if necessary.

Now for a few specific comments on the different forms shown on the drawing. In (1), (2) and (3) the front control wire has a short piece of wire soldered to it to serve as a filler. The rear control wire has a projection provided by bending its front end at right angles and extending it through a guide slot cut in the fuselage. The front control wire, its filler and the rear control wire are nested together and a sleeve of rubber or Neoprene [backed off in (3)] is slipped over them to provide a ready adjustment for the elevator relative to the control bar. Two small nails serve as the pivot pin and the stop pin. Several holes for adjustment of the stop pin can be provided as in (1). The arms of the pilot spring must be so formed as to contact both sides of the stop pin and both sides of the projection, to prevent any lost motion of the elevator when the control wire is held in neutral position by the pilot spring. Finally, a streamlined "blister" can be provided to cover the auto-pilot if desired to cut down drag.

In (4) the usual control bar pivot screw is replaced by a longer one to serve as a pivot for the pilot spring. The projection is a short piece of 1/8" diameter dowel cemented to the control bar. The stop pin is a length of 1/8" diameter brass rod soldered to a strip of tin or brass that serves to support it. Adjustment is secured by mounting the stop pin support on the control bar support by a screw that can be tightened to retain the adjustment. A calibrated scale can be associated with a pointer on the stop pin support to indicate the adjustment. Part of the lower surface of the wing may have to be cut away to make room for this type of auto-pilot.

The auto-pilot shown in (1) may also be adapted readily to the *Fireball* as it can be mounted on a suitable support of 1/4" x 3/8" balsa in either a vertical or horizontal position adjacent to the control wire, and the projection may be an L shaped piece of wire soldered to the control wire. A guide should be provided adjacent to the auto-pilot for the control wire to slide through to keep it from bending away from the auto-pilot when the projection moves one of the arms of the pilot spring.

In (5) and (6) the projection is a short length of 1/8" brass rod with a deep V groove around it. It is soldered in an eye formed at rear end of the control wire, and after being inserted through a 1/8"

hole in the elevator horn the pilot spring arms are snapped into the groove which serves as a retainer. This provides a convenient means of quick connection and disconnection when the stabilizer and elevator are removable as a unit from the fuselage. The pilot spring may be mounted on a support formed of iron wire about .035" to .050" in diameter (paper clip wire is suitable), which is cemented between a pair of grooved fuselage members of balsa or wood to anchor the auto-pilot. The iron wire forms the pivot pin and the stop pin and adjustment is obtained by merely bending the iron wire with a pair of pliers. If the pilot spring arms tend to drift out of alignment with the V groove, a pair of small washers may be soldered to the stop pin as shown by dotted lines. These should be slightly dished with the convex sides toward each other. It will be noted that the stop pin in this form of auto-pilot is between the pivot pin and the projection, an arrangement that doesn't work quite as well and necessitates considerable depth in the portion of the fuselage under the elevator horn to accommodate it.

Auto-pilots of the character suggested are easy and quick to make and may be the means of saving your plane from many an untimely crash and consequently hours of time in rebuilding it or making new parts. On the Whip Power plane it is very helpful in making a successful casting launch.

Design Forum

(*Continued from page* 35)

fourth requirement, therefore — usually the most important one—is stability.

Perhaps you have flown a large plane and when you stepped out on the ground again you felt all worn out. Your flight was a continuous battle with the controls, every maneuver required great concentration and strength. In such cases the airplane fights the controls—it is not easily controlled with little effort. Planes that are most satisfactory to fly respond to the slightest touch. So our fifth requirement is controllability.

From the standpoint of utility these five factors are the most vital ones. However, since most people desire some pleasure in flying, convenience and comfort are usually required factors. In fact, convenience contributes both to utility and comfort. For instance, to start the motor of some planes it is necessary to spin the prop by hand. Others have self starters. The self starter is not only a convenience but also contributes to safety. If the motor should stop in the air you can often get it going again quickly with a self starter. In the old days, without a starter, it was necessary to dive at high speed so the airstream would spin the prop and start the engine. This obviously is impossible without considerable altitude and, if close to the ground, can be fatal.

Another factor of convenience and also safety is visibility. It is not absolutely essential to have wide range of vision in order to fly, but to guide your plane without fear of running into some other aircraft is most comforting. So our sixth required factor is visibility.

Accessibility is our seventh factor. One should not have to be an acrobat to get in and out of the cockpit. The most convenient types of planes have short landing gears, allowing pilot and passengers to step into the plane and seat themselves without effort.

Of course the cabin appointments should have some degree of comfort so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that abnormal fatigue does not result from an hour or two in the air. The cushions should be soft and the seats at the right angle. Quarters should not be cramped. Instruments should be visible without changing your position. Vibration and noise should be at a minimum because they are most fatiguing. The eighth factor, therefore, is comfort.

Another feature that may be classified under comfort also embodies danger. It is the position of the propeller. This, as mentioned in our last issue, is the sore thumb of airplane design. When it is in the nose of a plane or mounted on the wings, anyone in the vicinity of the plane must be aware of the danger of this spinning prop. In attempts to remedy this, many designers have placed the propeller back of the wings and high so that passengers or mechanics servicing the airplane can approach it from the front.

This brings us to consideration of the ninth factor—easy servicing and repair. The part requiring the greatest care of course is the engine, which should be mounted so that all parts requiring attention can be inspected or repaired easily. Controls must be inspected and serviced frequently, hence they should be located so that it is not necessary to tear the entire airplane apart when repair or replacement is required.

Many planes available today embody all these factors to a high degree; considering these alone, we ask why more people are not flying their own airplanes. This is due to the most important factor of all—cost. The average man cannot afford to buy and keep an airplane. It is the one factor that prevented wide use of the automobile until the late Henry Ford solved the problem with his "flivver." So, if you wish to build and sell airplanes, your foremost consideration should be a low price well within the means of the average person.

All these considerations, provided you agree, give us the pattern we must follow in designing our craft. Apparently we must place performance secondary to cost, which means that our design must have the simplest type of construction, the least amount of material with the fewest number of operations to complete the job. The basic form of the airplane is dependent upon this condition, so in laying out your design think only of this and momentarily forget performance and other considerations.

* *

Let us consider some of the designs sent to us in the light of these requirements. One of the most unique is by Fred M. Taylor of Belleville, Ill. His design, Fig. 1, is a low wing pusher and comes close to being the best possible arrangement. The fuselage is light and small and can be made cheaply. The wing is low, therefore it is easily supported by the basic body structure without additional connecting parts. The rearward extension of the fuselage is a simple tube embodying less material and fewer operations than the common fuselage. The landing gear is comparatively short because the propeller axis is quite high. This makes it possible to bring the fuselage closer to the ground. The wing, therefore, is close to the ground and landing gear struts can be short. Mr. Taylor, however, has made one mistake in locating the rear wheels. These should be placed further forward so as to be approximately at the point indicated by arrow "A" slightly back of the center of gravity, CG. When wheels are placed as far back as shown there is considerable weight on the front wheel, and then it is

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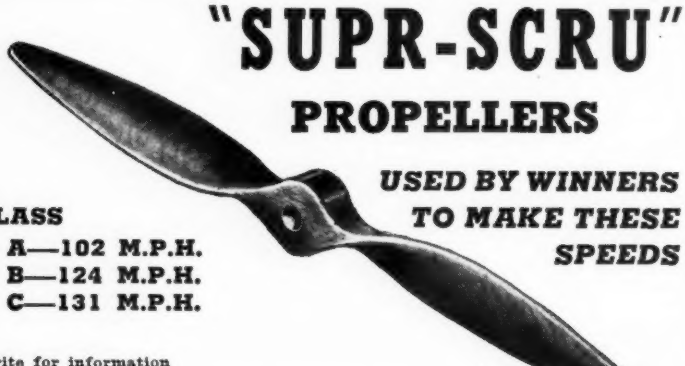

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difficult to nose the plane up for takeoff. This is accomplished by raising the elevators which causes a downward pressure on the tail. The closer the rear wheels are to CG the less tail pressure is required to nose the plane up for takeoff.

The only factor that might contribute to expense is the complicated and fairly heavy prop mounting. Note that the blades radiate outward from a collar that spins around the root of the tail boom. Radial bearings placed at intervals within the collar and around its circumference allow it to spin freely. It is driven by gears within the collar through a shaft leading to the engine within the fuselage and directly back of the pilot's seat. This system is unique and was first used on the famous Gallaudet airplanes. The arrangement not only makes it possible to have a simple fuselage structure, but it also locates the propeller in the most convenient place from the standpoint of safety and comfort. It is well out of the way of the passengers entering the cockpit and not in the line of general approach. No unusual form of construction is required to locate it in this position except the bearing in the hub. This is more complicated and heavier than the common form of prop. Nevertheless its use should not be rejected without careful consideration of the existence of other valuable factors which it makes possible. Mr. Taylor has evidently weighed the advantages and disadvantages, and we are inclined to concur with him that the extra complication of hub mechanism and drive is warranted in light of the simplicity, lightness and cheapness it makes possible. Performance also is increased by this type of drive because the airplane's crossectional area presented to forward motion is less than other types.

For instance, let us consider the design presented by Robert W. Forsyth Jr. of Sugar Hill, N. H., Fig. 2. This plane is similar to Mr. Taylor's in all respects except that the propeller has been raised to a point above the cabin, and two tail booms are used instead of one. We fail to see the necessity of two tail booms, however, because by raising the prop it is possible to obtain good clearance between the prop and a single tail boom extending back from the lower part of the fuselage.

The use of two booms makes it possible to have the propeller axis at relatively the same position as in Mr. Taylor's plane without raising it; so we see that in the case of these two planes there is a choice of using either radial hub mounting around one boom or the common form of prop with two booms. If you fear the radial form of prop mounting is too complicated, and you wish to use only one boom, then the propeller must be raised to provide proper clearance between the arc of its swing and the boom. This condition requires an outline similar to the side view of Mr. Forsyth's plane. Raising the propeller, however, necessitates greater crossection frontal area. The cabin must be sufficiently high to enclose the motor or propeller drive. This is bound to give greater head resistance and reduce speed. In choosing between these features it is a case of which you feel is the most valuable. From the standpoint of costs it is probably best to raise the propeller, extend a single boom rearward below its arc and eliminate the expensive radial propeller mounting around the single boom. Here we have a case of sacrificing a certain amount of speed for cost of production.

Now let us consider the planes in the

light of safety and speed. Both are low wings which inherently are faster than high wings. However, the rate of climb of low wings is usually less than high wings or parasol planes. These two designers evidently prefer to sacrifice rate of climb for speed. If the wing on Mr. Forsyth's plane is placed high in line with the propeller axis, slightly less speed may result, but it would climb at a steeper angle, which is very convenient in taking off from restricted areas especially those surrounded by trees etc.

As a matter of fact, when the propeller axis is high and the wing is high practically no loss in speed results. In the general setup of an airplane, remember that speed results from location of the line of thrust above the line of resistance of the aircraft. In both Taylor's and Forsyth's design the line of resistance is below the line of thrust. If the wing is placed level with the line of thrust, as in Forsyth's craft, the line of resistance still would be below the thrust line. Greater safety results from this high wing position because the lift on the wing is above the CG. In other words, the weight of the airplane hangs from the wing and acts as a pendulum, always tending to keep the plane in a level position or return it to normal flight attitude when displaced.

From this it is obvious that the general arrangement of a sport airplane for low cost, speed, a reasonable rate of climb and stability may be drawn as shown in Fig. 3. Here we have a combination of Taylor's and Forsyth's design. The fuselage forward is roomy enough to house the passengers comfortably. A reduced section or boom extends back from its lower part to mount the tail. The engine and prop are high enough to provide clearance between the prop and fuselage. The wing is high to give maximum stability and safety. On the whole, the plane is simple enough to be built at low cost. This partly depends upon simplicity of mechanical details as well as general form of the plane. For this reason the propeller is mounted directly on the engine rather than locating the engine lower in the fuselage and driving the propeller through a geared shaft, although this latter arrangement is possible and desirable from the standpoint of low CG and convenience of servicing. With the motor low, panels in the side of the fuselage provide easy access.

One of the simplest forms of power craft ever built is shown in Fig. 4. This reverses the position of prop and boom. In some respects it is more convenient than the variation in Fig. 3. However, this is only advisable with props of small diameter. The craft shown is similar to the outline of a powered glider now being manufactured and sold. A motor of only 25 hp drives a small diameter propeller. This makes it possible to have a reasonable distance between the boom and the ground at rear of the fuselage. With a large diameter prop either the boom would have to be raised into an awkward and undesirable position or the whole airplane would have to rest further from the ground, necessitating long landing gear struts. In many respects it is a toss-up between the two designs. The one in Fig. 4 will give a greater rate of climb, other factors being equal, than the design of Fig. 3 because the thrust line is below the line of resistance.

Troubles resulting from interference of propeller and boom can be completely eliminated by using two booms, as shown in Fig. 5. Here we correct certain undesirable conditions and run into others.

With two booms the prop and engine can be located lower, and head resistance can be reduced because of less frontal area. Fuselage structure can be simplified, but the cost is the addition of another boom plus either the addition of struts from fuselage to wing or greater strength in the wing panels between booms and fuselage. This is required because all the stresses from the tail pass through the boom to the wing and through the wing to the fuselage.

The weakest link in this chain is the structure between the boom and fuselage because here not only must tail stresses be taken care of but the normal flying stresses due to loads on the wing also occur. In other words, we are ganging up the stresses at one point. This, however, does not make the design impossible; it merely makes it necessary to incorporate great strength and rigidity in the wing between boom and fuselage. The most troublesome stresses here are torsional stresses. For instance, any pressure up or down on the tail tends to twist the wings about their spanwise axis. The loads on the wings at the same time tend to bend them upward. Therefore the structure must be designed to take a combination of bending and torsional loads of great intensity.

Struts running from the boom down to the lower edge of the fuselage will absorb these torsional loads. However, they also give added resistance and therefore reduce speed. Accordingly it is more advisable to build the inner wing panels sufficiently strong to take the combination of stresses. This requires more material but will increase speed. This price of slightly greater complication and weight is not too much to pay for the greater convenience and speed which it makes possible.

The two boom type is more convenient because visibility is increased to the rear due to the lowered propeller axis. With a high prop, rearward view windows are impossible. With twin booms and lower prop, windows at rear of the cabin make it possible to see any faster aircraft approaching from that direction. This type of plane may be made either as a high or low wing, depending on the designer's preference for slightly greater rate of climb or, on the other hand, slightly increased speed but with less stability. Structurally it is more convenient to place wings low, but less stability results.

It is also easier to land a high wing plane than a low wing because when the wing is close to the ground the air between the wing and ground is cushioned or compressed to such an extent that the airplane continues to float indefinitely at times instead of coming to rest on the ground quickly with a short run. If airport space is limited this characteristic actually may be dangerous. High wing planes are not as susceptible to such behavior. Flaps for slow landing also are more conveniently mounted and give better performance on high wings.

Some of our readers may differ in opinion or will have discovered some new methods of overcoming the difficulties of designing the average sport plane. Perhaps one of you has invented a jet engine which gives high efficiency at low aircraft speed. If so, you have solved the one problem that will make possible a sport plane in its simplest form. If you have a design you feel is unusual, send it in. Be sure to make your drawing carefully because, though we would like to publish all of them, it is only possible to print and discuss those which are neat and which we feel will be of greatest interest to our readers.

Polly Wants a Crackup

(*Continued from page* 23)

rudder area and wing dihedral.

To understand the reasoning back of this rule we must realize that spiral stability is really a combination of lateral and directional stability. Lateral stability is determined by the dihedral angle of the wing, directional stability by the rudder area (or more accurately, by the horizontal distance between CG and CLA).

Before considering this relation between lateral and directional stability, it will be profitable to review briefly the action of dihedral angle in a wing. We can readily see from Fig. 3 that when a model slips (or skids) the wing toward which it is moving is meeting the air at a relatively greater angle. This is easy enough to see when only two dimensional motions are considered. But the model is moving forward at the same time that it is slipping. As a result of this combined forward and sideward motion the low wing is actually operating at a higher angle of attack; hence it generates more lift and tends to restore the model to stable flight—either to straight and level flight or to a correctly banked turn. The idea of an actual increase in attack angle on the low wing is important.

Consider now the case of a model with inadequate rudder area. If it is momentarily diverted from its course, it does not have sufficient weathercock stability to return to its original heading at once but continues to turn until the restoring forces become great enough to swing it back into line. Often it swings too far over on the way back and continues to oscillate or fishtail. Because the rear of the model swings out in this way it is making a skidding turn. The wing on the outside of the turn is therefore operating at the higher attack angle and tends to bank the model into a stable turn.

But the outside wing also has the greater drag, due to this higher attack angle and to the fact that it is traveling faster since it is on the outside of the turn; consequently it will tend to restore the model to its original heading. If the rudder area is too small, however, the plane will continue to turn and roll past the original position until the restoring process repeats itself in the opposite direction. Thus, the fishtailing which is characteristic of a model with inadequate rudder area may be accompanied by a rolling motion. If the rudder is large enough, these oscillations will be damped out and the model will eventually return to stable flight. If the rudder is much too small, they will grow progressively worse until the model either spins in or goes into a spiral dive.

On a properly designed model—one with neither too much nor too little rudder area—these oscillations will not develop or will be damped out almost immediately. If for any reason a wing drops or if the model enters a slipping turn, the additional drag on the low wing due to its increased attack angle forces the model into a tighter turn at the same time that the low wing is coming back up. The model will thus enter a stable turn, neither slipping nor skidding, or will continue to increase its rate of turn and decrease its angle of bank until a skidding turn results and causes the plane to return to straight level flight.

But if the rudder area is too large the ship will have excessive directional stability. A skidding turn cannot develop for more than a brief instant, since side pressure on the large rudder will immediately bring the model back to its origi-

BEGINNERS COURSE

Lesson 4 in this popular course for newcomers to model aviation (in the next issue of M.A.N.) will describe construction of a "profile fuselage" model. This design (the next logical step after the stick model in this issue) looks like a fuselage airplane but is still very simple to build.

nal heading. And in the event of a slip the model will be unable to decrease its radius of turn relative to the angle of bank because of its excessive directional stability. At best it will enter a stable turn. But if the dihedral is too small for the amount of rudder area, the slip will continue. Pressure on the inside of the large rudder will then swing the model around into a tighter turn—but never tight enough to start it skidding. Thus the vicious circle develops. As the turn gets tighter the bank increases; as the bank increases the model continues to slip, causing the turn to become still tighter.

Excessive rudder area is responsible for the behavior of a model which spirals under power and rolls out when the engine cuts. The revolving propeller imparts a twisting motion to the airstream behind it, so that as long as the engine is running there will be a constant pressure on the left side of the rudder, keeping the model in a tight left circle. This creates the same effect as a continuing slip. When the motor cuts this side pressure on the rudder is no longer present, so that the model either enters a stable turn or finds itself skidding and begins to straighten out.

The exact amount of rudder area to use for a given dihedral angle can be determined only by experiment, although the experienced modeler can usually make a pretty fair guess at it. It is apparent from what has been said above that it is best to err on the side of too little rudder since this results in a model that tends to skid on the turns—an essentially stable arrangement. This, in turn, explains why it is so important to keep the CLA as nearly as possible on a line with the CG.

And yet, models have been designed with the utmost attention to these two rather well known rules for spiral stability and have ended their brief careers in a tangled mass of wreckage, victims of spiral dives. Their discouraged builders have decided that the old line about the bee being theoretically unable to fly but doing it anyway works just as well in reverse, and their aerodynamics textbooks have wound up in the salvage drive. The real trouble lies in the fact that these two basic rules for designing a spirally stable model are only a part of the story. A third rule, theretofore ignored or unknown, is just as important as the other two.

Rule 3: Don't use too much dihedral at the wingtips.

Theoretically, polyhedral or tiphedral is a good idea. Advanced wing theory tells us that the most efficient type of dihedral is one with the shape of a half ellipse. The polyhedraled wing is a working approach to this ideal form.

But from the standpoint of spiral stability, polyhedral may be definitely bad. To understand the dangers of excessive dihedral at the wing tips we must realize that a model airplane wing is usually flying very close to the stalling angle. Since the model is designed for endurance, the wing will usually be operating at an attack angle three or four degrees higher than that at which the lift to drag ratio is highest—in order to obtain a slower glide with a lower sinking speed. Furthermore, because of scale effect, the stalling angle of a model airplane wing is usually much lower than the airfoil characteristics charts indicate. The wing may therefore be operating within a few degrees of the angle at which it stalls.

With this fact in mind, it is easy to see

what happens when a model with excessive tip dihedral begins to slip. The attack angle of the low wing increases to the stalling point. Instead of coming back up, the low wing continues to drop because it is losing rather than gaining lift as the stall develops. Meanwhile the drag of the stalled wingtip is increasing, and the turn gets tighter and tighter. Once this process has begun nothing can stop it except an encounter with some solid object.

No rule can be laid down at this time to determine the limiting angles of polyhedral or tip dihedral. Common sense is our only guide. A study of successful models reveals that the angle of the wing tip dihedral seldom exceeds ten degrees to the horizontal. Much more than this should not be necessary in a properly designed model of average proportions, provided the rudder area is kept down to 7 to 10% of the wing area.

Baby Mixmaster

(Continued from page 37)

with landing gear attached in proper position; when thoroughly dry glue forward nose block in place.

Get a large spool of thread from the family sewing kit. Cut off flanged end as shown, then drill the 3/8" hole. After hole is drilled, cut in half and form a recess 1/16" deep to hold the ball bearing. Get a small hinge (I used a hinge from a broken pair of glasses which served the purpose quite well) and fasten the two halves together, adding hooks on the other side as shown. Line the recess with part of a rubberband fastened in place with rubber cement. Since the recess is to hold the ball bearing this rubber lining prevents it from slipping. The last operation is to glue this locking support in its proper place at the tail end of the fuselage and let it dry thoroughly.

WING—This is of simple capstrip design, and you will find this method of construction light, yet very sturdy. Note that no solid ribs are used, but each rib is formed of an upper and lower capstrip, preshaped and separated at the thickest part of the wing by the main spar. Materials used were as follows:

Main spar (tapered toward each end) . . . . 3/16" x 1/2" x 39"
Leading edge . . . . 1/4" sq.
Trailing edge (tapered to triangular crossection) . . . . 3/16" x 1/2"
Ribs (Capstrips) . . . . 1/16" x 1/8"
Supporting spar . . . . 3/16" x 1/2" x 39"

The supporting spar is tapered as noted on the plans and glued to centersection spar or dihedral brace before adding capstrips. Pin the main spar to drawing board; then raise the spar approximately 1/16" to allow lower capstrips to fit in their respective positions. Glue lower capstrips to spar and allow enough time to dry. Then add leading and trailing edge and top side capstrips. Glue and let dry. Add wingtip and wingtip cross supports as shown. Note that each tip is raised 2-1/2" above the centersection to give correct dihedral. This dihedral is provided when the main spar is being glued together.

STABILIZER AND RUDDER—Rudder and stab are of capstrip construction, same as the wing. The sizes of wood required are:

Main spar . . . . 3/16" sq.
Capstrips . . . . 1/16" x 1/8"
Outlines . . . . 1/8" sheet

Make three halves alike as rudder and stab are identical. The ribs are formed to a thin symmetrical section and the 1/8" thick sheet outlines sanded to blend in smoothly.

CONTRA-ROTATION PROP SYSTEM—To construct the tubing, cut a sheet of balsa 1/16" x 3" x 25" and soak in hot water; then wrap around a 7/8" dowel or pipe using gauze to hold it in place until dry, preferably allowing it to stand overnight. When the balsa tube is completely dry, wrap scotch tape diagonally covering the entire tubing; this strengthens the tubing considerably and does not allow the tube to warp under stress.

Both plugs as shown in drawings are cut from a thread spool. This material is ideal for the purpose as there is 1/4" hole in the center. The powerplant consists of the balsa tube with front bearing, and a shaft and two flanges at the rear. The front shaft is of 1/8" drill rod with two holes, one for the wire pin that holds the rod and shaft to the wood plug, and another hole for the rubber hook. In the original model, the end plugs had 1/4" holes, so the front shaft was slipped into a short piece of 1/4" O.D. tubing and the wire pin was run through this as well.

The rear shaft, also of 1/8" drill rod, likewise has a hole for the wire rubber hook. The shaft turns in a piece of tubing which is sweated into another tube. The tubes are firmly held in the rear plug by two steel pins forced in from each side.

The forward-most prop is held by a flange sweated to the inner tubing. Against the rear surface of this prop rests a ball thrust bearing, and last of all comes the flange for the rear prop, which is held to the shaft either by two setscrews or by a pin. It can also be sweated to the shaft for extra security.

This whole assembly can be lightened considerably if the tubing and flanges are made of aluminum; but then, of course, none of the parts could be sweated together, and pinning them would be a bit tricky.

The props are carved from medium hard balsa and you must have them of opposite pitch but alike as possible.

Note that the forward and aft plugs are removable for easy access to rubber and for easier winding. Both plugs fit snugly into the outer tubing; both ends of the latter have a narrow slot on each side so the pins need not be removed to take the plugs out.

COVERING—The model is covered with Silkspan, sprayed with water to tighten, then doped. Colored paper may be used if desired and decorated as you see fit. The original ship has the Marine Corps emblem on the rudder and is brightly colored.

FLYING—It is advisable to make the first few flights from a smooth surface, allowing the model to take off by itself with only 50 turns in the rubber. As you perfect the adjustments, the turns may be increased up to 200. If you are sure of your rubber you can increase this; but should the rubber break it will surely make a mess of your balsa tube and probably the fuselage as well!

The original model was a bit tail heavy; this was remedied by packing a little modeling clay in the hollow nose. If the motor tube were made full fuselage length with the forward bearing at the very nose, it would help correct for tail-heaviness and give increased motor run.

You will certainly find the absence of torque effect a blessing as it makes adjustment extremely easy, and the model flies straight as an arrow without twist or turn.

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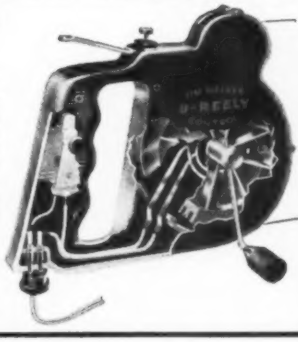

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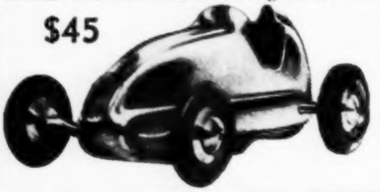

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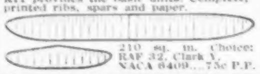

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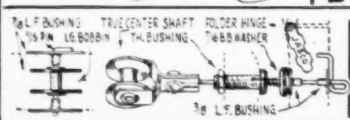

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Pusher Sportster

(*Continued from page 17*)

side frames, glue soft balsa blocks between these pieces of sheet balsa. Later we'll round off the whole, and when it is sanded you don't notice the joints. After the top and bottom crosspieces are in position, put in the 1/4" x 1/2" hardwood mounts. These are slanted as shown on the plan in order to give the model downthrust. We should say the *effect* of downthrust, because you use just the opposite on a pusher to get a nose down force.

The firewall and the fuselage section immediately forward are given on the plan. The cowl consists of 3/16" sheet side pieces with the grain running fore and aft. Between these side sheets and the motor bearers, insert other pieces of sheet (cut to same outline). The best way to do this is to get some C-clamps and a few pieces of plywood to protect the balsa from the jaws of the clamps; then glue and laminate the cowl sides. Let the sections stand overnight to dry.

The landing gear is 3/32" music wire. The usual 1/16" wire is on the flimsy side for a substantial Class A model like this one (about 290 sq. in. wing area). This wire is held in place against the front of the firewall by a "sandwich," consisting of pieces of 3/32" sheet balsa inside the U-shape, and on both sides of the U, the whole being covered with a piece of 1/4" sheet with the grain running across the fuselage. Use plenty of cement. Additional 1/4" sheet gussets are fitted to the front of the "sandwich" and are glued against the fuselage sides. If you want to avoid elongation of the holes in the fuselage sides where the landing gear wire comes in, make (from thin sheet metal) two washers which have on them points that can be bent over and sunk into the wood. Slide one washer over each side of the landing gear wire and glue and imbed the washers into the wood of the fuselage.

A long Aero Spark coil was used on the original. If two round holes are cut in the sheet balsa sides of the nose, this coil just fits between the sides with the very ends of the coil flush against the outside of the airplane. The timer is just aft, inserted through a round hole cut in the 1/8" sheet mounting. The wing hold-on hooks are attached, one to the back of the upper cabin block and the other to the back of the firewall, with its end bent over and pushed through a small hole in the firewall. Glue both of these hooks well. A small block should be glued over the rear hook to help keep it in place against the plywood. The bottom of the cowl is made from 1/4" sheet which fits into the notch that you see on the plan. Glue one edge of the sheet first, then bend it down and pin in place while the whole thing sets. The grain runs across the fuselage. When you cover the fuselage, use Silkspan and double cover with the grain of the covering running at right angles. Launching a pusher is a bit awkward, and we were forever poking holes in the paper.

The tail is conventional. However, we have used extra area in consideration of the fact that most of the profile area of this ship is far forward, due to the pod-and-boom layout. There is one rudder on top of the stabilizer on the centerline of the airplane. The two subrudders are glued, one each, to the bottom of the stabilizer just beneath the position of the booms. Part of the subrudders fit into the spaces between the double ribs provided at the boom stations. The subrudders are made entirely from 1/8"

sheet, with front and rear edges having vertical grain and the section in between being filled with very soft sheet with fore-and-aft grain. We suggest gluing the rudder lightly in position until you find out how you wish to turn it for adjustments. Then it can be attached firmly.

The wings offer one problem due to the sweepback, and that is how to join the spar butts at the dihedral breaks. We cut a single joiner from 1/4" sheet and tailored it to fit; then made another just like it in reverse for the other side of the wing. Small gussets placed on top of the spars and against the sides of the end ribs help hold the dihedral. Finally, gussets at the leading and trailing edge at the "breaks" complete the reinforcement. The ends of the top spar, being well glued together, are a further help.

The centersection is cut out to provide access to the engine compartment. Part of the bottom of this centersection is filled in with 1/4" sheet for strength and to give the wing a solid base on the fuselage top. Other sheet balsa is used as noted on this part of the plan to give the centersection cut out its rounded edges. Since we did not have to worry about weight, we beefed up the spar sizes by employing 1/4" x 1/2" on the bottom of the wing, and to prevent warping a 3/16" spar on the top of the wing. The leading edge is a generous 1/4" x 3/8" which can be nicely shaped to fit the rib contours. The section is something we cooked up from the old reliable Eiffel 400 of our rubber days. The bottom of this section has been modified by replacing the undercamber with a flat bottom. It has been our experience that a Clark Y causes too great a difference in trim from the NACA 6409 with which we are most familiar. Desiring a flat-bottomed section for simplicity, we went to the thicker Eiffel 400 and tried to gild the lily. It seems to work okay. Three inches of dihedral on each side is more than enough.

The booms are built up from frames of 1/4" square and 1/4" sheet balsa, laid out like fuselage sides. When dry, each boom is covered on each side with 1/4" sheet. The whole is then cut to the outline given on the plan and shaped a la solid models to the necessary crossections. Give each boom three coats of clear dope and sand with fine paper between coats. One-eighth inch dowel pegs are forced into the ends of the booms and cemented. The hold-on rubbers go under the boom, then over the wing, and wrap around the front dowels. The tail is attached in the same manner, only the rubbers go over the booms then under the tail to wrap around the dowels.

To provide access to the battery box we made the entire windshield removable. It should be built with the fuselage; then a razor blade can be inserted where the cement may have held to the body. Cover the cabin windows and windshield with celluloid before removing the windshield. A pin through the cabin roof prevents the windshield from slipping out in flight.

Covering is Silkspan, water sprayed, and given three coats of clear dope that was cut to 2 parts dope and 1 part thinner. However, the consistency of dope varies widely so use your judgment. To avoid warps we water sprayed one panel of the wing at a time and pinned that panel flat while the paper pulled tight. Then we went on to the next panel. This isn't essential but it is a worthwhile practice.

Adjustments are not out of the ordinary. The batteries can be moved fore

and aft for balancing, and the trim of the wing and stabilizer can be altered as desired with small slivers of sheet balsa placed under the proper edge.

Most engines are not designed for pusher operations, though judging by the Yogi nobody had much trouble. There are three ways of tackling the pusher prop: pick up a lefthanded prop (we got hold of a few from Yogi kits), make your own lefthanded prop, or reverse the direction of rotation of the engine. Once you have finished with this one inconvenience, your pusher sportster will repay the trouble with many fine flights.

Simplified Radio Control

(*Continued from page* 21)

This Rhodes spoon (for want of a better name) worked out very well in tests, and its only drawback was the fact that it rotated so fast that it would break the selector spokes when stopped by the radio unit.

The last and one of the most important improvements was brought about by moving the pivot point one-third of the way over from one end of the spoon as in Fig. 2. I found that thin *shim stock steel sheet* was the best to work with, being very light and strong. This steel spoon takes a terrific beating without becoming unuseable. A small drop of solder applied to the short side of the spoon counterbalanced it very well. Note that the short portion of the spoon is at the same angle as the long portion and not opposite as in an ordinary propeller. It is this short section that bucks the action of the larger section and slows the rotation to a more practical speed. The spoon has to be balanced by adding or filing the solder counterbalance on the short section, or it will vibrate slightly when it is rotating.

By placing the shaft at this one-third point on the spoon rather than having the whole blade area at one side, the following improvements were made: (1) the rotation was slowed to a reasonable speed; (2) the spoon was almost centralized in relation to the axis of the fuselage. At the same time this placed the whole control surface where it is at its most balanced position to control on a vertical or horizontal plane. This unit was built flat against the rudder and about half way up from the rudder base. The spoon stuck out in the rear of the tail assembly just far enough to rotate freely, and down far enough so that in the event the ship nosed over upon landing, the top edge of a sturdy rudder would protect it from damage (see Fig. 3).

The latest unit, including the selector mechanism (to be described) weighs only 5/8 ounce. The size of the spoon, of course, depends on the size of the ship, and the only way to determine this correlation is to start with a small size and work up. I found that the best results are obtained with a tail assembly that has about the same approximate area in the rudder as in the stabilizer. This way you don't over-control on rudder and under-control on the elevator. The larger the spoon, the more control. I found after a few trials that the smaller the tail surface, the smaller the spoon could be to get the same degree of control. Also, the most efficient angle for the spoon was about 45 degrees on the shaft and curved as in Fig. 1, end view of the spoon.

By moving the ignition batteries forward a couple of inches I compensated for the added weight on the tail. The drag of this spoon that so many model-

makers told me would affect the glide and efficiency of the plane just wasn't noticeable. Although there is no doubt that the spoon does cause some drag, it isn't serious even under conditions calculated to make it show up. You will notice in the photograph that the spoon has been placed so that it is in front of the rudder. This worked successfully, but with a marked decrease of control for a given size of spoon, due of course to its surface being closer to the ship's center of gravity (shorter moment arm). In later experiments it has been used solely in the rear of the tail assembly with much better results.

I am indebted to my friend Ted Freeman of Phoenix for his assistance in constructing and operating the *Flying Quaker*, the first of two ships built for control purposes. It was found that a spoon whose dimensions were 1 to 3 in. proved best, neither under-controlling nor over-controlling this ship. If you desire to go in for some aerobatics, however, you will merely have to increase the size of the spoon slightly and keep on your toes when flying.

The second ship was a *Commander*. It was much faster and more thrilling to watch than the *Quaker*. Its receiver used no B batteries, so the small diameter fuselage was not crowded in the least. This ship was much more successful, as the radio trouble was brought to a minimum with the new equipment, and more time could be devoted to actual flying. The use of a butterfly "V" tail section was tried on this ship with great success as one less surface had to be constructed and the control unit was mounted on the fuselage between the "V" arms.

Now for the selector. It is unnecessary to give exact dimensions here as the selector runs very well, even with a sloppy fit in the bearings, and the overall dimensions of the entire unit may be changed to suit one's taste without greatly affecting its operation. Everything can be made so small that it weighs only a fraction of an ounce, and it will still control a ship just as well as a larger unit.

There are two types of units that may be used for selection. The first is rather a hit-and-miss affair but will operate successfully if one practices a bit in order to get the sequence correct. It is made by fastening a four spoked wheel to the end of the shaft as in Fig. 4. The spoked wheel (A) is cut out of a disc of brass, a hole is bored through its center the same size as the piano wire shaft (B), and the two are soldered together at (C). The spoon which is shown at (D) is soldered at (E) to the shaft, then counterbalanced at (F). The balance doesn't have to be perfect because the weight involved is so small that the vibration produced from a slight unbalance amounts to nothing. The bearings shown at (G) were made to fit just loose enough for free rotation and are made from a piece of aluminum plate bent as shown at (H). This piece acts as a mounting bracket for the unit as well.

The only disadvantage of this unit is that one never knows what position he will come upon first when the key at the transmitter is depressed. However, the sequence will run either "Up, Right, Down, Left" or "Up, Left, Down, Right," depending on the direction the spoon is rotating. Of course the little armature (I) of the solenoid (J) will stop any one of the spokes the first time, but thereafter one has almost instantaneous control over any position. For instance, if the first position is "Left," then by making the Morse M and holding down the

key on the last dash the position will change to "Right." One quickly learns to control with this system, but there is always that uncertainty about the first position.

By making the selector wheel (Fig. 5) so that one spoke remains fixed at all times and the other three (I) swing away from the shaft by centrifugal force, you have an arrangement where the fixed spoke always comes in contact with the armature rod first. This spoke can be set on any position of control by soldering the spoon on the shaft so that with the armature rod extended and the spoke against it in the direction of rotation, you have a "First" position that never fails when you press down the key the first time. Always set this spoke on the elevator "Up" position; then if the ship is coming in at a steep angle your first effort at the key will prevent a crackup and save time in getting the proper position.

Although this unit is a small, simple and light affair, it can still stand a lot of refining. As far as mechanical complications are concerned though, there just aren't any. It may be said here that the pressure and direction of the wind (A) against the spoon (B) holds the rotary system against the bead regardless of whether the fin is in neutral (spinning) or in a stopped position. The loop (C) of steel wire is soldered on the shaft to prevent the movable spokes from flying out too far from the shaft. The spring at (D) came out of a dollar watch. It is adjusted so that when the shaft and the movable spokes (which are soldered to the spring) are upsidedown it will have just enough strength to hold the spokes to the shaft against the force of gravity when the spoon is standing still. The other end of the spring is wrapped to the shaft with fine copper wire (E), then sweated into a solid piece with solder. It may be well to add here that the shaft is doubled back at (F) and then again bent at 90° to form the fixed spoke (G). The sweating of solder along this fold will add plenty of strength providing it reaches the 90° bend. Do not worry about taking the temper out of the steel parts as loop (C) will prevent too much bending in the case where a high speed spoon is used. Be sure the spring tension is such that the movable spokes will fly out with not too much speed of rotation.

To balance the unit, tie the spring to the loop at (H) with the movable spokes (I) extended as they will be when revolving. This is the position in which vibration will become noticeable and not in the still position when the spoon is stopped. Balance for running conditions and forget about balance on the stopped position, as air pressure on the spoon will insure perfect automatic operation so long as the plane is moving through the air.

The solenoid in use on this unit is one purchased from a camera shop and was originally used for electric shutter operation with a flash camera. This solenoid (J) has a little pin (K) that sticks out of one end; when current flows through the coil this pin sticks out about 1/8 to 3/16 of an inch further with considerable force, more in fact than is needed for reliable operation. Naturally, while the spoon is spinning (this is called neutral) the movable spokes are extended by centrifugal force, and the only thing the armature can contact is the fixed spoke, so the fin has to stop in that position first every time the key is first depressed. As soon as the spoon is stopped for a fraction of a second, centrifugal force ceases on the movable spokes and they are

pulled back to the shaft by the springs. The key at the transmitter is again lifted for a fraction of a second and again depressed; this action causes the armature to snap back into resting position long enough to allow the wind to rotate the spoon a little past the catching point of the fixed spoke; then the armature comes out again to stop the next spoke, and so on through the four positions. When the key is released, no matter what position the selector is in the spoon quickly comes up to the speed of the neutral position. Remember that the speed of the neutral rotation depends entirely on the counterblade of the spoon (short section)—the longer it is, the slower the rotation.

Supposing that the spoon rotates in the same direction as the propeller of the ship, the sequence will be Up, Right, Down, Left; Up, Right, etc. With the fixed spoke set on the Up position, the first signal dash would start the ship climbing and the up-elevator position of the spoon will persist until the operator releases the key. If the ship has been properly adjusted, it will not be necessary to give a Down signal to level the ship. If the operator lets up the key and instantly depresses it again, the armature will catch the next tooth; but if the operator waits about a half second to one second, the spoon will assume the neutral position automatically, thus making itself ready again for the Up position upon first contract of the key.

The nice part about this system is that the operator has any position at his fingertips at any moment he desires it. Then, too, the movement of the craft drives the spoon and there is nothing to run down. For the Up position the Morse letter T or dash is used. Its length will be up to the controlling operator and will determine how long the spoon will stay on the first position. In the Right position is the Morse letter M with the last of the two dashes held down for any desired amount of right turn; and for Down the letter O with the last dash held down for as long as the operator wishes to dive the ship. Left is four dashes with the last dash as the controlling factor for that position. It is always the last dash that is held down in the sequence of four positions that holds the spoke until the operator wishes to let go.

Anyone wishing to use the plain four spoke solid selector wheel will find that with very little practice he will be able to control nearly as well as when the spring-spoke unit is used. However, he will have to guess at that first position.

This simple control unit may of course be used with any of the popular transmitter and receiver units. The solenoid is simply connected in series with a pen-light cell and the contacts of the sensitive relay. After working out such a simplified control unit, however, I decided to see what could be done to further simplify the receiver, and so of course to cut the weight that had to be carried in the plane.

The first effort along these lines was what might be called a "hot wire relay," and though it worked, this was soon superseded by a much more practical hookup which represented just about the ultimate in simplicity, consisting as it did only of a 1/2 wave antenna, a crystal detector (I used the tiny 1N34 unit) and a low resistance relay, all in series. The contacts of the relay connect to the pen cell and solenoid of the spoon unit. This layout is so ridiculously simple yet it worked beautifully. There is a hitch, however! In order to operate the ship reliably up to a half mile, it was found

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necessary to use a transmitter of about 100 watts power, and to employ a complex beam antenna besides. Because of the necessity of the beam, the wave length should be 2 meters or less, and of course the beam antenna has to be turned to keep it pointed at the airplane.

The only tuned circuit in the plane was the antenna, which must be cut accurately to 1/2 wavelength. The "ground" part of the system included the motor plus a sheet of thin aluminum in the plane, and the antenna was fine copper wire glued to the wing trailing edge. Since this wasn't long enough, the end was allowed to hang off the wingtip and trail backwards in flight.

This gave a desirable "L" shape to the antenna which eliminated the blind spots that were noticed when I previously had the whole antenna running back along the fuselage and trailing from the tail. Some of my model building friends predicted dire results aerodynamically as a result of the trailing wires, especially that from the wingtip. Flying tests showed, however, that these wires had no effect whatever on the model's flying qualities.

An improved circuit in this simple form is shown in Fig. 6 and is recommended in place of the circuit just described. Here the half-wave antenna is split at the center with a one turn coupling loop which is closely coupled to a similar loop in the crystal circuit. The antenna must still be tuned carefully to the operating frequency, of course, but this arrangement obviates the need for a "ground" connection.

A tremendous improvement in operation may be had by using a simple tuned circuit as in Fig. 7. This tuned circuit, composed of coil A and condenser B, are coupled to the antenna by a one turn loop. In this case the relay coil should be very high resistance.

It was found possible to use greatly decreased transmitter power using this arrangement, and though it is a bit more complex than that in Fig. 6 is still eliminates the batteries and other troublesome parts associated with the usual vacuum tube receivers.

By using this simplified equipment it is possible to put radio control in the smallest powered models or even in rubber types. We have simply transferred the complications from the airplane equipment to that used on the ground, where weight means very little, and added complexity is also tolerable.

Air Ways

(Continued from page 31)

each state and from foreign countries on the basis of their performances in sanctioned meets. There are 12 events for rubber powered models (indoor and outdoor) and 18 in gas including both free flight and control line. A really worthwhile set of prizes has been provided including six thousand dollars in cash to be distributed to 150 winners, in addition to 93 fine trophies. All interested should send a card or wire to Headquarters, 1st International Model Plane Contest, Box 658, Detroit, Mich. They will receive a book of Information and an entry blank. There is no entry fee. The Board of Judges will include Merrill C. Hamburg, Contest Director, and Dr. Walter Good, President of AMA.

* *

Picture No. 1 shows Clarence C. Jacoby Jr., 1446 So. 16th Ave., Maywood, Ill., holding his scale control line model of a

For full details turn to Page **87**

United Air Lines *Mainliner 180*. The ship has 57" span, is powered by 2 Forster 29's, and has made over 100 flights to date with no crackups. Clarence, who is employed by United Air Lines as a draftsman, writes that his ambition is to build models of all of United's planes. The DC-3 model was obviously very successful, and Clarence has started constructing a four engined DC-4 with 70" span which will be powered by 4 Forster 29's. It will have a retracting tricycle gear, motor control, and all interior detail including cabin and navigation lights.

No. 2 shows a B29 built and photographed by Neil H. Palmer, 529 12th Ave. W., Menomonie, Wis. The windshield is formed of plexiglass which was worked to shape and inletted in the frames. The front wheel is swivelable. This model was completed two years ago and is one of fifty 1/4" scale models built by Neil. He finds that his two hobbies of photography and modeling fit in very well as he photostats and enlarges plans for his use and also photographs his own models.

No. 3 pictures the glider, *Ali Baba*, built by Oskar Eklöw, Schantzgatan 2a, Örebro, Sweden, who writes that he has built 50 models, most of them to scale. He did not send any construction details for his glider, however.

Gerald Kluge, Rte. 2, Osseo, Minn., contributed No. 4 which shows his *Duplex* built from plans appearing in November 1945 M.A.N. He writes that this model flew very well.

No. 5 was submitted by Cpl. John B. Martin Jr., 13198502, 6441 Sydenham St., Philadelphia 26, Pa., and is an exact flying replica of the 1929 *Golden Eagle C-5*. It was built over two years ago, and with it John was able to win the 1945 Indoor Flying Scale Model Championship of the Philadelphia Model Airplane Assoc. This model has flown for over a minute R.O.G. in Philadelphia's Convention Hall. It has proven a rugged ship and made over 40 flights without repair. It features such details as dummy motor and exhaust, aileron, rudder, and stabilizer horns, fully movable empennage, fire extinguisher, instrument panels, pitot tube, working shock absorbers, various lifts and steps, plus other details in india ink.

No. 6, by Leland Lord, 4320 W. Verdugo Ave., Burbank, Calif., shows his model of the Driggs *Dart*, a one place lightplane of the 1920's. He writes that the *Dart* is ideal for a flying scale model because it has a long tail arm, a high aspect ratio cantilever wing, and even a pylon-like cabin. The model deviates from the original only in increased dihedral and elimination of two struts from the tripod landing gear. Since the original had a 2-cylinder engine, the Elf *Twin* makes an ideal powerplant.

Mike Jordan, 21 Grosvenor St., Kenmore 17, N. Y., Corresponding Sec'y. of *Flying Bisons*, sent in No. 7 of an original model built by Warren Grier, a new member who has come to the club from Calif., bringing with him a rotary valve Ohlsson engine which he states performs much better than the regular Ohlsson 23.

No. 8, submitted by Harmon C. Parker, SK3/c, USCG Yard, c/o Finance, Curtis Bay 26, Md., shows his model of the Grumman J4F-2 which we were surprised to learn took only a weekend to build. The only parts he made for it were the props and wheels, the rest being made of scrap balsa odds and ends. There are bucket seats and tiny controls in the cockpit, which is enclosed in celluloid. The model was finished with 5 coats of white and sky blue dope, sanded down

between each coat—certainly a fine looking job for just a weekend!

Carl E. Monson, Rte. 1, Box 140, Fair Oaks, Calif., contributed No. 9 which shows his Siemens-Schuckert D-4 scaled down from Bill Wylam's plans appearing in January and February M.A.N. He writes that he only flight tested this model once, but it proved quite satisfactory. It took off with an engine speed just a little more than idling and showed remarkable climbing ability. It is powered with an Ohlsson "60" which is mounted in inverted fashion.

No. 10 was sent in by Duane Wilson of 2232 Cedar Ave., Long Beach 6, Calif., who writes that this original model has 312 sq. in. wing area, weighs 24 ozs., and is powered by an Ohlsson "23." Although not intended for contest work, it recently placed 5th in a club contest against models of all classes, with a total time for three flights of 10 min., 12 sec.

No. 11, by John M. Lux, 2136 Berteau Ave., Chicago 18, Ill., shows his *Swoose*, built from M.A.N. full size plans. The model has not yet been test flown, but it tied for first place in the Chicago Times sponsored Ninth Annual Model Airplane Exhibition held in conjunction with the International Sportsmen's Show. The model is powered with an Arden .099 engine and is all white with red trim. John made the special buffed aluminum spinner to fit the engine.

Guy Ramaekers, 31-35 Av. Felix Marchal, Brussels, Belgium, sent in No. 12 of his indoor autogiro which has made flights of 30 and 40 min. This model is also used as an R.T.P. (Round-The-Pylon) model. A modeler since 1934, Guy is now interested only in unorthodox models.

NEWS OF MODELERS

Henry W. Leslie, Dixie Aviation Co., Owens Field, Columbia, S.C., would like to contact someone who has plans (solid and flying) for old type planes such as Waco's, Curtiss Robin, Eaglerock, Travelair, Gypsy Moth, etc.

Jack Winans, 611½ Richmond St., London, Ontario, Canada, wishes to correspond with other gas model fans, especially those who will tell him how their local contests were run, what prizes were awarded, etc.

Geoffrey Eastough, 15 yrs. old, would like to correspond with an American modeler. Interested readers can contact him at 104 Shobnall St., Burton-on-Trent, Staffordshire, England.

We received a note from A. E. Bailey, 631 Crewe Road, Wheelock, Sandbach, Cheshire, England, enclosing a letter addressed to Robert G. Chaplick who was in the American Navy in Combat Aircraft Service Unit (F) Nine in the Pacific when last heard from. We shall be glad to forward this letter if Mr. Chaplick will contact our editorial offices.

Donald Evans, 38 Lowthorpe St., Moss Side, Manchester 14, Lancashire, England, desires to correspond with an American modeler interested in exchanging books and plans. Donald, who is 18, is primarily interested in duration models and gliders, although he is now waiting for good weather to test his new rocket plane.

CLUB NEWS

California

The *Albany Control Flyers* participated in the Army Day Air Show at Camp Stoneman on April 12. Jim Smith's French Spad model won the 1st place trophy—3d contest in which this model has taken 1st place. In Class C Precision Tom Mosely won the first place trophy and

REVOLUTIONARY LIGHTPLANE

Front cover of August MODEL AIRPLANE NEWS will feature the THORP SKY SKOOTER, a new two seated sportplane with many interesting features. Since this ship has ideal proportions for a model, the August issue will also include a free flight diesel-powered scale model of the SKOOTER, designed by Jim Noonan.

Ed Dunkum came second. Win Biscay, who sent in this news, won third in Class A Precision.

* *

A new club, *Sky Kings*, have elected their officers: Pres. Paul Brown; Vice Pres. Tommy Mead; Sec'y.-Treas. Stewart Frederick; Senior Advisor Paul Durnell. Interested modelers should contact the Venice Hobby Shop, 12906 Venice Blvd., Venice.

* *

The San Francisco Recreation Department announced results of their Class A Glider Contest held March 15:

Junior Division—1. Jack Ritner. 2. Larry Giordanengo 3. Jack Hillard.

Micro Division—1. Dale Parks. 2. Ted Kendrick 3. Jerry Hillard.

* *

San Diego Aeroneers held their 2d annual Western States Free Flight Model Plane Championships under sponsorship of the San Diego *Journal* on April 27 at Aeroneer's Kearney Mesa Field.

* *

June and Jack Dyer's *Aeroneer* listed the following results for *East Bay Aeroneers Assoc.* R.O.W. contest on March 9:

Class A—1. Valponi.
Class B—1. Foote 2. Steese.
Class C—1. Hubbard 2. Watkins 3. Doane.

Also from the *Aeroneer* comes news that the *Airfoilers U-Control Club* has again become active. Officers are: Pres. Bob Riley; Vice Pres. Don Holms; Sec'y. Leosa Riley; Treas. Laura Zimmerman.

* *

Fresno Gas Model Airplane Club lists in *The F.G.M.A.C. News* these results of their U-Control Meet held March 30:

Class A—1. J. R. Jackson 2. Billy Price 3. Alvin Costa.

Class B—1. Jim Whitlatch 2. Francis Marshall 3. W. E. Richards.

Class C—1. Vestor Warner 2. Fred Hover 3. Emory Hull, Jr.

Precision—1. Roy Mayes 2. Jack Summer 3. M. Kyle.

* *

From *Northern California Model News* comes the results of the Third U-Control Contest, March 23, sponsored by Exchange Club of Vallejo for the Sky Jockeys:

Senior Class A Speed—1. Mal Anderson.

Senior Class B Speed—1. T. Heaslett.

Senior Class C Speed—1. W. Osborne 2. E. Huth 3. Joe Libonati.

Junior Class B Speed—1. Don Rourk 2. Bud Traversi.

Junior Class C Speed—1. Buzz MacKerracher.

Senior Class B Precision—1. Ray Regalia 2. Roy Mayes 3. Win Biscay.

Senior Class A Precision—1. Ray Regalia 2. Win Biscay 3. Art Zugnoni.

Senior Class C Precision—1. Ed Kroll 2. Ed Dunkum 3. Gene Learnard.

Junior Class A Precision—1. Jerry Ketten 2. Royce Van Bebber 3. David Marshall.

Junior Class B Precision—1. Bill Thumberg 2. Dave Bennett 3. Joe Walters.

Junior Class C Precision—1. Don Hollfelder 2. Dave Pedracci 3. Walter Maus.

Novelty—1. Snuffy Duffy 2. Billy Peden 3. Howard Puckett.

Team—1. Don Bunchell, Don Vis, Lloyd Vis. 2. Don Butman, Tom Frazer. 3. J. Swenson, R. Heise.

Flying Scale—1. Jim Smith 2. Joe Fricker 3. L. Bazurto.

The *News* also contained following results of the Indoor Record Trials held Feb. 23 by *Oakland Cloud Dusters*.

Hand Launched Gliders Class A—1. Harvey Robbers, Sr. 2. Art Wells 3. Manny Andrade.
Class A R.O.G. Stock—1. Bob Blau.
Class B H.L. Stick—1. Bob Blau.
Class C H.L. Stick—1. Mike Demos.
Class D H.L. Stick—1. Carl Rambo.
Class B R.O.W. Fuselage—1. Carl Rambo.
Class B—1. Manny Andrade 2. Pete Demos 3. Bob Blau.

* *

A newly organized Oakland U-Control Club known as *Leona Barnstormers* will do their flying at Leona Park. Officers are: Pres. Hoben Thomas; Vice Pres. Eric Moline; Treas. Elvin E. Hedburg; Sec'y. Jimmy Teeslink. Anyone interested should contact the Sec'y. at 3290 Morcom St., Oakland.

Illinois

The *Torque Jockies Club* of Champaign-Urbana elected these officers on April 4: Pres. Elwood T. Ankrum; Vice Pres. Richard Schulenburg; Treas. Murray Watkins; Sec'y. Cecil Marsh; Club Coordinator Dave Jaffe.

We received a letter from Joe Locasto of 537 Seventh St., La Salle protesting the "1st in Peoria" claimed by Edward L. Brown of the *Torque Jockies* for his club in the May issue of M.A.N. Joe claims there was a tie for first by Ray Wirges, Princeton, and Lyle Burtron, Peotone, their speed being 102 mph, and that the closest the *Torque Jockies* could have come would have been third. Any comments, *Torque Jockies?*

Iowa

The *Davenport Model Airplane Club* completed preliminary arrangements for a two-day model contest to be held June 28-29. The contest will be Class AA, AMA sanctioned, with events for rubber, free flight, and U-control. Provisions are being made for meals and refreshments to be served at the grounds, and lodging accommodations are being arranged. Inquiries should be addressed to the club c/o Y.M.C.A., Davenport.

Kansas

A model airplane demonstration was part of the program at the May 4 dedication of Strother Field as joint municipal airport for Arkansas City and Winfield.

• •

Plain Tips, official publication of *Wichita Planesmen*, reports the results of their indoor glider contest March 23:

Open—1. Darrell Miner 2. Stan Chilton.
Senior—1. Jack Brown. 2. Glenn Hill.
Junior—1. Wayne Bates 2. Bill Pendleton.

• •

Dope Fumes, publication of Wichita's East Side YMCA *Hy-Flyer Clubs* and The Mid States Model Aeronautical Assoc., reports formation of the second largest men's Hy-Flyer Club of Wichita under the name of *The Flying Maniacs Hy-Flyer Club*. The group meets every Friday at 8 p.m. in Jake's Hobby Shop, 334 S. Seneca. This west side club is open to any experienced modeler, man or woman. Charles Alger is Pres. and Jake Winfrey the sponsor.

Massachusetts

Allan J. Garmon, Pres., sent in news of the formation of the new *Christian Hill Model Airplane Club*. Other officers are: Vice Pres. and Treas. Ray Boutilier; Sec'y. Gardner Gill. Anyone who builds flying models and resides in Lowell is invited to join; contact the president at 575 Beacon St., Lowell.

• •

Pres. William A. Alex of Brockton's *Cape Cod Cloud Chasers* writes that this club, which has been in existence for one year, has its interest equally divided among free flight, speed, and stunt flying. Other officers are: Vice Pres. Al Miele; Sec'y. Fred Andrews; Treas. Herb Vilk. Business meetings take place 1st and 3d Thursdays at the Brockton Y.M.C.A.

Michigan

Plymouth Motor Corp. will sponsor the 1st International Model Plane Contest in Detroit on August 13, 14, 15, 16. (Details will be found on page 31.)

Missouri

The Fourth Annual Missouri State Model Airplane Contest sponsored by Columbia Junior Chamber of Commerce will be held June 22 at Columbia. Rex P. Barrett II is Contest Director.

Nebraska

The *Omaha Model Builders Council* is

trying to give the builders of their vicinity a program they will enjoy. Beginning May 18, at which time the American Legion Post No. 1, will sponsor an AMA contest at Benson Model Park, there will be model activity programs each Sunday afternoon. Officers of the Council are: Pres. Fred Shinrock; Vice Pres. Oscar Olson Jr.; Sec'y. Mrs. John Fluehr; Treas. Dwain Stocker.

New Jersey

Joe Bligh sent in news of the *Atlantic City Sky Blazers*. It was formed last Nov. 2 at the main YMCA and now has a membership of 15. They keep up a club photo album, and two members have darkrooms with enlargers. The first section of the album has a page per member while the succeeding pages carry photos as they are made. They recommend an album to any club. They are interested in getting more members (especially with cars and starters!); meetings are held every Friday at 8 p.m. in the main YMCA.

* *

The Second Annual Atlantic City Control Line Model Airplane Championships were held May 4 at Cadets' Lodge Drill Field. This contest was sponsored by the Lt. J. Willis Gale Post 215, VFW, and events included Class A, B, and C Speed, Stunt and Scale.

New York

The *Watertown Aeromodelers* will hold their Northern New York Outdoor Invitation Model Airplane Meet, sanctioned by AMA, on June 8 at Watertown. Events will include Glider (tow line and hand launched), Rubber (cabin R.O.G. and stick), and Gas, Class A, B and C. For further information write John D. Morrow, Contest Director, 1134 Boyd St., Watertown.

* *

The *Screamin' Demons* of Hempstead will hold their Long Island Invitational Championships on June 8 (rain date June 15) near Hicksville, L. I. The field will be announced as soon as definite information on the availability of three alternate sites is received. Officers of this club are: Pres. William K. Johmke; Vice Pres. Fred J. Otten; Sec'y. Lt. Charles Burtner; Treas. Robert Goldsmith. Pres. Johmke can be reached at 90 Terrace Ave., Hempstead.

* *

The *Long Island Model Flyers* of Oceanside held their club U-control Contest which was in the precision flying category and was held over a period of three weeks, March 9 to 23. Results, sent in by Club Sec'y. Richard Kosby, are:

1. Larry Kosby 2. Dick Kosby, Ernie Pfeiffer, and Joe Fasani 3. Bill Weidicker.

* *

The *Sky-Scrapers* of Brooklyn will hold their Fifth Annual Eastern States Championship Meet on August 24 (rain date August 31) at Hicksville, L. I. Besides the usual A, B and C free flight, there will be a "Free for all" consisting of all classes of free flight gas with a 10 second motor run. For further information write Arnie Penenberg, 305 Martense St., Brooklyn 26.

North Carolina

The *High Point Model Masters* will hold their Second Annual N. C. Free Flight Championship, State Qualifying, on June 8 at High Point Speedway on Highway 311 between High Point and Winston-Salem. Walter B. Thomas, Jr. is Contest Director and may be reached at Box 831, High Point.

Ohio

The American Legion of Hamilton County is sponsoring a Model Airplane

Contest to be held at Lunken Airport June 21-22, AMA sanctioned. The Army at Wright Field will stage demonstrations on both days. The entire meet will be under the supervision of L. R. Aicholz of the American Legion, Bill Oker, Regional Coordinator of AMA, and Milt Specter, Regional Contest Director of AMA.

* *

The *Warren Modelers Assoc.* will hold their Annual Model Airplane Contest July 27. The events will be both free flight and U-control under AMA rules.

* *

James Cutright, Richard Porter and Clifford E. Osborne of *Chillicothe Flying Gremlins* write that their club is equally divided into free flight and U-control builders. However, these three members are the only builders of towline models in the club. Last summer they enlarged the plans of a Thermic 70 and made a 140, a plane with a wingspread of 11' 8" which was completed and tested six days after drawing up the plans. They are looking forward to flying this ship again this summer at "Thermic Field" and hope to put radio control in it.

Oregon

Results of the Tri Club Control Contest held March 30 in Salem by *Salem Cloud Chasers, Salem Model Airplane Club,* and *Portland Gasshoppers* are:

Speed C—1. Jud Fuller 2. O. Brown 3. Y. Myako.

Speed B—1. Southerland 2. Wetherby 3. J. Hudsbith.

Speed A—1. R. Smith 2. F. Zemerly 3. R. Kern.

Stunt and Precision—1. D. Hudsbeth 2. J. Hudsbeth 3. McKenzie.

Pennsylvania

There will be a Model Airplane Memorial Contest sponsored by Gimbels at South Park Model Airfield, Pittsburgh, on May 30. Events will include free flight gas, Classes A, B and C; control line, Classes A, B and C; rubber powered models; and radio controlled models—sanctioned by the Pittsburgh Conference on Model Aeronautics.

* *

Donald Vannan of Danville wrote in to nounce formation of the new *Gas Guzzlers Model Club.* They have use of a nearby airport which is perfect for take-offs and landings. Present membership is 31, but interested modelers in the vicinity are invited to join by contacting Donald at 107 E. Mahoning St.

Walter H. Dunning of *West Chester Model and Hobby Club Inc.* sent in news of the construction of a new building for this club. It will house a photographic darkroom with all equipment, sound-proofed room for engine operation, complete workshop with all power tools, and a large auditorium equipped for sound movies.

A control line contest will be held July 4 in Fairmount Park as part of *The Evening Bulletin's* annual Independence Day celebration. The contest will be co-sponsored by the Exchange Clubs of Philadelphia and the Metropolitan Council. It will be followed by a free flight

contest early in September. Last year the contest was operated smoothly with four circles. This year there will be 12, with a newly devised motor class division system. All six control line classes will fly for the same prizes. However, winners will be determined by the model that comes closest to—or exceeds by the greatest amount—the national record existing in the class 10 days before the day of the contest.

Under the new system it will be possible for the winning plane to travel as low as 90 mph, and for the plane achieving second place to go as high as 120 mph. This seeming injustice is explained by the fact that the lower speed plane will have overcome the handicap of a much smaller motor. Official instructions with reference to this new rule will be forthcoming from AMA headquarters in the near future.

Tennessee

Kenwood S. Carter, Contest Director, sends us news of the Second Annual State Model Airplane Meet to be held at Nashville July 4 and 5 with Post No. 5 of the American Legion, the Nashville Aero Club and *The Banner* as joint sponsors. The meet will be AMA sanctioned, and events will include towline glider, rubber powered stick fuselage models, 3 gas model classes, A, B and C, control line classes 1 through 6, and scale model planes.

Texas

The Control Line Gas Model Meet held at Kelly Field, San Antonio on April 12 included events in Speed, Stunt, and Beauty, a Balloon Busting Contest, Dog Fights, and a Jet Event. This AMA sanctioned contest was held in observance of Army Week.

Norway

Helge L. Jacobsen, Pres. of the *Gjovik Flying Club*, writes that their membership is 120. In 1939 they built a Grunau 9 glider which won many prizes but was lost to the Nazis in 1941. They are now building a new one, and their junior group of 40 boys are building model planes. As supplies for modeling are most difficult to obtain in Norway, they are anxious to correspond with interested modelers or clubs who would be willing to trade some American equipment.

Plane on the Cover

(*Continued from page 25*)

tell you that the fighter and bomber boys have an easy time of it compared to the "VP" design groups.

What will enable an airplane to fly a very great distance? The answer to that question is still being sought, but many answers have already been revealed. These answers fall into two broad categories: design and operation, both equally important and one useless without the other. The design problem revolves around two basic problems: use of a large fuel load, and the problem of obtaining maximum miles from each pound of fuel weight. It may be advisable to point out here that "range" and "endurance" are not synonymous, endurance being the problem of obtaining the maximum hours from each pound of fuel weight, a considerably different problem.

The performance of the patrol plane depends almost wholly on two factors: aspect ratio and parasite drag. Aspect ratio (square of the span divided by wing area) is the basic controlling factor in airplane range because of its influence on the induced drag, which may amount to as much as 70% of the total drag of a

wing. The induced drag is that portion of the drag created by the wing tip vortices, which stream off the tips like giant corkscrew streamers.

A high aspect ratio wing, however, is a long, narrow wing which presents a difficult structural problem. One solution to this problem is the use of taper in such a manner that the wing chord is gradually reduced outboard to the tips which, in turn, reduces the spar loading towards the tip. Taper, however, particularly of the leading edge, introduces another complication in outboard spanwise flow which results in premature stalling near the tips and loss of aileron effectiveness.

The most efficient angle of attack is that angle at which the L/D ratio is greatest. This is the ratio between lift of the airplane divided by drag, and maximum efficiency is obtained at that angle at which the greatest lift is produced at the least cost in drag. The angle of maximum L/D is the angle at which the least power will be required to fly the airplane at a given speed and, therefore, the least fuel will be used. This angle is similar to the wing loading of the airplane, the latter being the weight (or lift) of the airplane divided by the wing area (or drag). Therefore, the wing loading must be determined on the basis of the airfoil L/D, a high L/D airfoil being capable of accommodating a high wing loading design.

Selection of the powerplant requires even further compromises. The engine must be designed to operate at its most economical cruising speed, which produces the least fuel consumption; but this engine speed must coincide with the desired airplane speed at which the L/D is at maximum.

The operation of the airplane comprises the other half of the battle, and this subject is too complex to discuss at length here. An index to its complexity can be gathered, however, from the fact that as each gallon of fuel is consumed the weight of the airplane is reduced, which means it can be flown more slowly at a given angle of attack, which means the engines can be throttled back further, which means the fuel consumption can be reduced, which means the rate-of-reduction of weight is lowered—the circle is endless. Prior to a long range flight aerodynamicists lay out long, complex "cruise control" charts presenting in great detail the changes in throttle, mixture, propeller pitch, airplane trim, airspeed, etc., that must be made as the flight progresses. Careful adherence to these charts can increase the range of an airplane 25 to 50%, depending on conditions. Whereas winds have no effect on airplane endurance, they have a decided effect on airplane range. Suffice it to say, however, that a head wind reduces the range of an airplane more than a tail wind of an equal amount increases it; the maximum range of an airplane is less in a steady wind than in a calm, and a head wind on the way out reduces the range of the airplane less than a head wind on the way back!

It is against this brief engineering background that the significance of the Martin XP4M-1 can be more fully appreciated. A glance at the photos will reveal some of the things we have discussed: the long, narrow, high aspect-ratio wing; the large vertical tail set well back from the wing; the extremely clean, low-drag design of wing and fuselage; the large, high-efficiency propellers; the cambered, high-lift wing for high L/D ratio; and the tremendous power available for lifting great fuel loads.

The giant patrol plane is of conven-

tional layout but introduces one innovation to long-range aircraft: the turbojet engine. Each powerplant nacelle houses one Pratt & Whitney R-4360 reciprocating engine in the nose driving a propeller, and one General Electric I-40 turbojet engine exhausting through the rear of the nacelle. To the question, "Why a jet engine on a long-range airplane?" it must clearly be noted that the turbojet engines on the Martin XP4M-1 are *auxiliary* power only and used mainly for takeoff and for high speed runs at altitude. Following takeoff and climb to cruising altitude, the two jet engines are cut off completely and the big ship settles down to the two reciprocating engines for the long cruising flight ahead. When enemy fighters appear, the two turbojet engines are started and the giant patrol plane climbs up and moves away at a speed approaching 400 mph.

Two factors in the patrol plane that we have not discussed in the long-range problem are armament and tactical load, both of which rob the type of range, but both of which make it a military weapon and a practical combat airplane. The patrol plane normally works alone or in small groups and must, therefore, rely on its own armament for defense. The P4M mounts three power-driven Martin turrets; one in the extreme nose, one in the tail and one in the upper rear turtleback, or "dorsal" position as the British term it. In addition, there are waist guns on either side of the aft fuselage.

In the spacious belly are provisions for a variety of demolition bombs, torpedoes, depth charges or mines, depending on its mission. The search radar spinner is mounted in a streamlined, plastic housing under the after belly. A large variety of radio equipment may be mounted in the P4M for the various missions it may be called on to perform.

The 40-ton giant has a 114 ft. wingspan and is 82½ ft. long. The crew is made up of a pilot, co-pilot, navigator, radar-radio operator, and four engineer-gunners—a total of eight. The pilot and co-pilot are located in a streamlined "blister" high atop the fuselage to provide maximum visibility.

Performance of the P4M is given as the familiar "well over 350 mph" with jet engines operating, and "slightly over 200 mph" cruising on the reciprocating engines. Range is "over 3000 miles" but wartime experience tells us these figures are extremely conservative.

Two experimental models were built, the first of which flew last October. It has since been undergoing extensive contractor flight tests and the photos reveal some of the research instrumentation installed for the flights. Particularly noticeable is the long boom projecting from the nose, which is not standard tactical equipment but is used for measuring accurately the airspeed and angle of yaw of the airplane when flown through various maneuvers.

As advanced in design and concept as the Martin XP4M-1 is, representing all of our wartime experience in the design and utilizing the newly-developed combination powerplant unit, the giant craft may go down a victim of political battle. Debate over the logical position of the land-based patrol plane in the Army Air Forces or Naval Aviation has been settled tentatively by the recently revealed Army-Navy merger plan, in which the Navy was allowed to keep its shore-based patrol planes. By cutting Bureau of Aeronautics procurement funds for patrol plans, the Navy's plans for the P4M and other land-based patrol planes have been torpedoed.

But whether only the two Martin XP4M-1 patrol planes are built or a thousand procured, the engineering achievement of its design and construction will remain as a high water mark in the history of the patrol plane—and it comprises, today, the epitome of methods of seeking out the enemy and gaining knowledge of his "position, strength and direction of movement." For the XP4M-1 is a direct descendant of Mercury, the ancient and fleet-footed harbinger of the enemy!

Flash News

(*Continued from page 14*)

5000 lbs. of thrust. It is rumored that one of these *Nene* engines will be used in Grumman XTB3F-1 now nearing completion following inability of Navy to obtain J-33 engines from AAF.

PLANS ARE far advanced for an early speed record attempt by AAF with the new Lockheed P-80R at Muroc. Return of warm weather increases the speed of sound from less than 700 mph to 760 mph at the base, thus enabling the P-80R to fly "faster" before severe compressibility troubles are encountered. The P-80R differs from the military version in having a new thinner wing, flush air intakes and special tail pipe after-burning in the jet engine, which can increase thrust 100% for short periods.

CONFIRMING THE theory of countless amateur engineers, Sir Malcolm Campbell, British speedboat king, is installing a De Havilland *Goblin* jet engine in his new *Bluebird* racing boat. The 3000 hp engine is mounted just above waterline with the jet directed along surface of the water. Air intakes are mounted high and forward to prevent entrance of spray. The new engine will weigh 430 lbs. less than conventional engines formerly installed yet provide more than twice the power. Campbell's existing speed record is 141.7 mph.

THE AVERAGE pilot today is young and hasn't much money, according to CAA, who reveal that 50% of all pilots are in 20-24 and 25-29 age groups, although they comprise only 19% of the total population more than 16 years of age. Only 10% of pilots are 35 or more, and very few are 55 or over. Only 5% of pilots make $5,000 year or more.

ONE OF THE well-kept wartime secrets can now be revealed: use of model airplanes by the Navy for transonic speed tests (see picture on pg. 2). Models of Grumman F8F *Bearcat* to scale of 4/10 full size (14 ft. span) of wood are carried aloft in Boeing PB-1W (Navy B-17's) and dropped. The models are not powered but contain 500 lbs. of lead in nose. The models attain transonic speed during the drop and are "pulled out" of the dive by automatic controls, after which a parachute opens and the model is recovered. The models contain telemetering equipment to transmit research information. The tests are centered at Naval Air Experimentation Station near Philadelphia and are designed to produce data on high speed flight without the risk of pilot or aircraft.

THE BRITISH have converted the Gloster *Meteor*, world's speed record holder, into a 2-seat training plane, far and away the fastest trainer ever built! Student and instructor are located tandem under a large bubble canopy. Dual controls are fitted. Top speed of *Meteor Trainer* is 585 mph!

AAF has started flights over North Pole for meteorological research purposes, using Boeing B-29 *Superforts* especially equipped. The flights originate at Ladd Field, near Fairbanks, Alaska and are termed a "public service" because the weather information is relayed to weather reporting and analysis stations throughout U.S.

AAF announce the Bell XS-2, special sonic research airplane, as being a modified version of XS-1. The new version has sweptback wings and is of stainless steel construction to absorb the terrific heat generated by sonic speed, which is expected to amount to more than 100° F. over the outside air. The XS-2 will join XS-1 at Muroc where they will continue sonic research work in cooperation with NACA.

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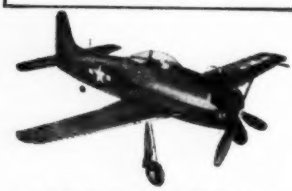
New—The "BEE"

Wingspan 24". For .23 to .49 engines, for 2-line Autotrol speed flying, and U-Control stunt flying. With pre-shaped all balsa wings. Die-cut plywood fuselage and Autotrol parts; formed landing gear; streamlined Hely-Arc rubber wheels; Berkeley cement. Complete hardware, including hinges, bolts, nuts, and special stampings.

The perfect speed model. Easy to handle at high speeds with Berkeley's special laminar flow type wing. Easy to build, it can be assembled in a few hours. Rugged plywood-balsa construction outlasts other types of speed models.

Complete kit $3.95



"F8F" Grumman "BEARCAT"

For stunt and precision performance. 35½" Wingspan with Autotrol plus U-Control. 1" equals 1 foot scale. For .45 to .65 engines. Model has automatic rudder control with ground-operated U-Control elevators, making possible many new stunt aerobatics and flight patterns. Model features a rugged full-planked fuselage, formed bubble canopy, rubber wheels, in addition to the usual Berkeley completeness of materials.

Complete kit $5.95

Republic P-47 Controliner

1 in. equals 1 ft. scale. For .19 to .60 engines. 40¾" Wingspan. "We are now flying five of your P-47 Controliners at our school," reports one Controliner enthusiast. The only model with operating flaps and engine control in addition to U-Control. Complete Kit.................... $5.95

Berkeley Controliners are the only control line models manufactured under both Bill Effinger "Autotrol" Patents and Jim Walker "U-Control" Patent No. 2292416.

North American Mustang P-51 Controliner

For precision flying. 37" Wingspan with 3-line Autotrol for .19 to .30 Displacement Engines. The first and last word in controlled gas models. You operate trim tabs, landing gear, throttle and flaps while in flight. Automatic elevator, rudder and flap operation; laminar flow type wing without interference from control lines; aluminum spinner; formed bubble canopy air wheels; formed wire landing gear; completely cut-out plywood parts.

Complete kit $7.95

The "BAT" Controliner

32" Wingspan with 1 or 2-line Autotrol for .49 to .65 engines. Plans show upright or inverted engine installation for three different style engines. Features: Laminar flow type wing; simple plywood and balsa fuselage construction; shear-pin motor mount; Berkeley aluminum spinner; formed landing gear; streamlined Hely-Arc rubber wheels. Complete kit $4.95

The "BUG" Controliner

17½" Wingspan with 1-line Autotrol for .099 to .23 engines. Actually test flown at speeds exceeding national record by 20 mph. Easy to build and fun to fly. Get the BUG for control line flying pleasure. Features: Preformed all balsa laminar flow type wing; formed landing gear; streamlined Hely-Arc wheels.

Complete kit $2.95

CONTEST DIRECTORS ATTENTION: Each year Berkeley has awarded contest prizes through the Academy of Model Aeronautics. This year we are awarding $1000.00 in Trophies, Lockwood Chronographs, and Waterman Fountain Pens. These awards are being distributed on a regional basis for sanctioned contests.

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